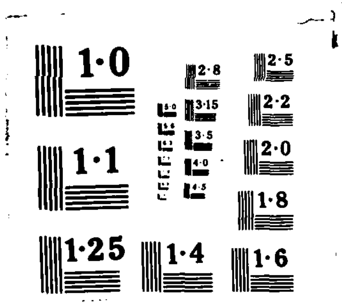
AD-A167 734 GEOTECHNICAL DATA INVENTORY SOUTHERN CALIFORNIA COASTAL ZONE CAPE SAN MAR..(U) ARMY ENGINEER DISTRICT LOSAPEAKE ANGELES CA COASTAL RESOURCES BRANC.. DEC 85 DIV 1/2

UNCLASSIFIED CCSTWS-85-5 F/G 8/6 NL


1·0
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·5
2·8
3·15
3·5
4·0
4·5

(13)

US Army Corps
of Engineers
Los Angeles District

COAST OF CALIFORNIA
STORM AND TIDAL WAVES STUDY

GEOTECHNICAL DATA INVENTORY
SOUTHERN CALIFORNIA

CCSTWS-85-5
December 1985

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: CCSTWS 85-5 / 2. GOVT ACCESSION NO.: AD-A167734	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): GEOTECHNICAL DATA INVENTORY SOUTHERN CALIFORNIA COASTAL ZONE CAPE SNA MARTIN (MONTEREY COUNTY) TO MEXICAN BORDER	5. TYPE OF REPORT & PERIOD COVERED
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: GEOTECHNICAL BRANCH, LOS ANGELES DISTRICT US ARMY CORP OF ENGINEERS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: US ARMY CORPS OF ENGINEERS/LOS ANGELES DISTRICT P.O. BOX 2711/ ATTN: SPLPD-C LOS ANGELES, CALIFORINA 90053-2325	12. REPORT DATE: DECEMBER 1985
	13. NUMBER OF PAGES: 169
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

COPIES OBTAINABLE FROM UNITED STATES ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT, PLANNING DIVISION OR THROUGH NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

GEOTECHNICAL COASTAL PROCESSES
COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY
SEDIMENT PROPERTIES GEOLOGIC PROCESSES
CLIFF EROSION

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

THE DATA INVENTORIED IN THIS REPORT COVER GEOTECHNICAL SUBJECTS SUCH AS THE PHYSICAL PROPERTIES OF THE SEDIMENT, THE PRESENCE OF LANDSLIDES IN THE DRAINAGE BASIN, THE PRODUCTIVITY OF THE DRAINAGE BASIN, AS WELL AS DATA ON CLIFF EROSION RATES. INFORMATION ON GEOLOGICAL PROCESSES SUCH AS THE LOSS OF SAND TO SINKS SUCH AS SUBMARINE CANYONS, OR BEACH SAND DUNE BUILD UP IS ALSO GIVEN. THE DATA ON THE PHYSICAL PROPERTIES OF THE SEDIMENTS INCLUDES TEXTURE AND PETROGRAPHIC INFORMATION ON SAMPLES COLLECTED FROM SUBMARINE CANYONS, THE CONTINENTAL SHELF, THE LITTORAL ZONE, LAGOONS, DUNES, CLIFFS AND DRAINAGE

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

BASINS. THE DATA IS PRESENTED IN TABLES AND INDEXED GEOGRAPHICALLY ON MAPS. THE MAP INDEXES SHOW THE AREAL COVERAGE OF THE REPORTS FROM WHICH DATA WAS ABSTRACTED.

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

GEOTECHNICAL DATA INVENTORY
SOUTHERN CALIFORNIA COASTAL ZONE
CAPE SAN MARTIN (MONTEREY COUNTY) TO MEXICAN BORDER
Ref. No. CCSTWS 85-5

Coast of California Storm and Tidal Waves Study

U.S. Army Corps of Engineers
Los Angeles District, Planning Division
Coastal Resources Branch
P.O. Box 2711
Los Angeles, California 90053

DECEMBER 1985

Summary

The data inventoried in this report covers geotechnical subjects such as the physical properties of the sediment, the presence of landslides in the drainage basin, the productivity of the drainage basin, as well as data on the rate of cliff erosion. Information on geological processes such as the loss of sand to sinks such as submarine canyons, or beach sand-dune build up is also given. The data on the physical properties of the sediments includes texture and petrographic information on samples that were collected from submarine canyons, the continental shelf, the littoral zone, the lagoons, and dunes, as well as the cliffs and the drainages. The data is presented both as tabular information and as map indexes. The map indexes show the aerial coverage of the reports from which the data was abstracted from.

Contents

Contents (Cont'd)

FIGURES

PLATES

1. Introduction

Objectives

1.1 This report is an inventory of Geotechnical data that will be used as a reference in order to develop the Plan of Study for the Cape San Martin to Mexican Border segment of the Coast of California Storm and Tidal Waves Study.

Purpose and Scope

1.2 The Coast of California Storm and Tidal Waves Study will collect and analyze basic oceanographic, meteorolgic, geologic, and sedimentologic data in order to form a basis to define and assess coastal changes. This report will serve as a summary of geologic, geomorphic, and tectonic information. The inventory will serve as a guide that will aid in developing geomorphic framework reports and in planning future field sampling activities, laboratory testing, and office analyses. The scope of this inventory study extends from Cape San Martin to the Mexican border.

Authority

1.3 This storm and tidal wave study is being undertaken pursuant to Section 208, of the Flood Control Act of 1965, Public Law 89-298. The authorization dated 27 October 1965, reads in part as follows:

* * * * * * * * * * * * *

SEC. 208. The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes. including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the localities specifically named in this section.

* * * * * * * * * * * * *

1.4 The study was initially funded by the House Appropriation Committee in its Report No. 97-177, 97th Congress, 1st Session (page 23). The Committee also directed the Corps of Engineers to concentrate on the Dana Point to Mexican border segment of the study (House Report No. 97-177, page 23). The Committee, recognizing the severe cliff and shore erosion conditions that exist along the coast of southern California from Dana Point to the Mexican border and also being aware of an apparent lack in existing sand supplies for natural longshore transport and deposition on the area's beaches, authorized a comprehensive study of this important coastal area to develop the basis for an action program to reduce and, where possible, to prevent harmful effects of shoreline erosion. To avoid duplication of effort and to insure multi-

jurisdiction support, technical state-of-the art coverage, and cooperative effort-sharing, the Corps was directed to accomplish the study taking into account such information and assistance as may be available from State and local governments, organizations, and institutions and other non-Federal sources.

Prior Reports

1.5 The following related reports prepared by the Los Angeles District contain significant data on littoral zone sediments.

Title	Date
Beach Erosion Control Report on Cooperative Study of San Diego County, California Appendix IV, Phase 2.	March 1960
Beach Erosion Control Report Cooperative Research and Data Collection Program of Southern California, Cape San Martin to Mexican Boundary. Three-Year Report 1964-1966.	March 1969
Three-Year Report, 1967-1969 Cooperative Research and Data Collection Program Coast of California.	December 1970
CCSTWS 84-4 Geomorphology Framework Report, Dana Point to the Mexican Border.	September 1984
CCSTWS 84-4 Sediment Sampling, Dana Point to the Mexican Border (Task 1D, Nov.-83 to Jan. 84).	November 1984

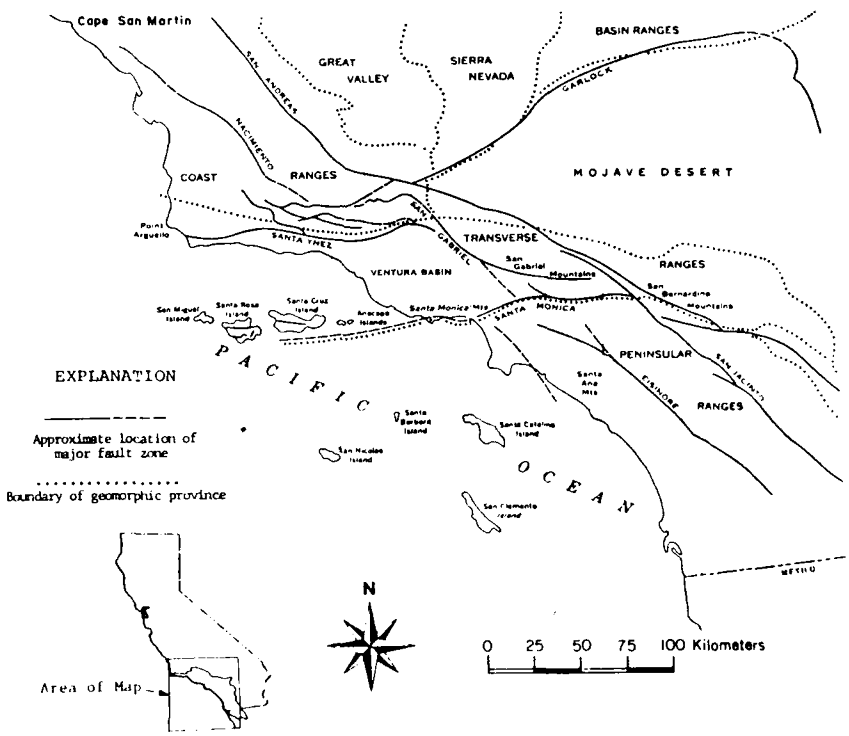
Regional Geology

1.6 The following paragraphs will present a brief description of the geology of the three natural geomorphic provinces of the study area. Those three provinces include the Peninsular, Transverse, and Coast Ranges Provinces (see fig. 1). Each province is characterized by its own climate, physiography, and geology. All of those characteristics play a roll in influencing coastal process along the littoral zone.

Peninsular Ranges Province

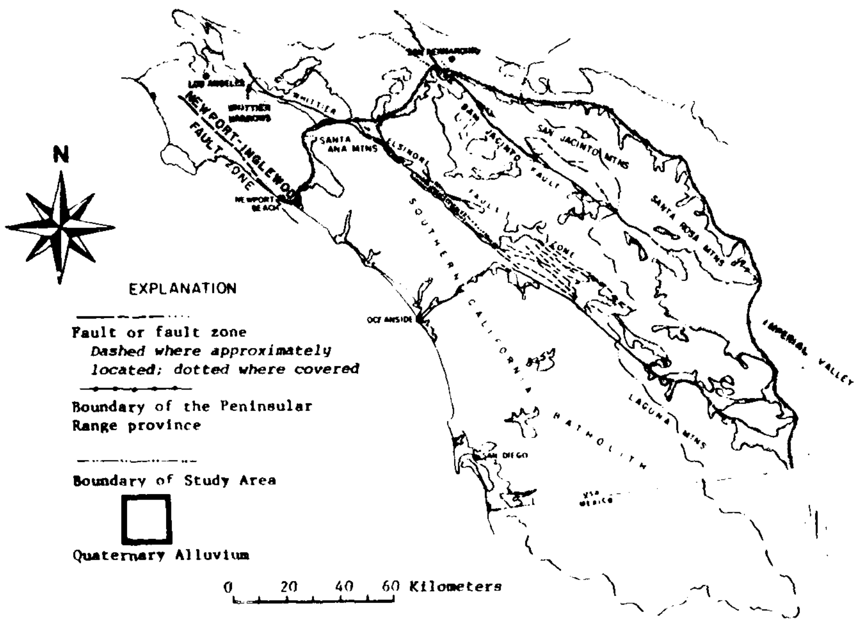
1.7 The Peninsular Ranges Province extends from the Mexican Border on the south to the Los Angeles Basin on the North (see fig. 2). The coastal section of this province consists of two types of landforms, the coastal plain, and the coastal foothills and mountains. The coastal plain dips gently seaward, and it is somewhat featureless, with the exception of moderate to small sized rivers and creeks that flow westward to the ocean. The average elevation is 350 feet above MLLW (Mean Lower Low Water). The climate of the coastal plain can be characterized as semi-arid, with little or no rainfall during the warm summer months, and moderate to heavy rainfall during the occasional heavy storms that occur during the winter. Average annual precipitation is 12 inches per year.

1.8 The coastal foothills and mountains range in elevation from 500 to more than 6,000 feet. Most of the mountainous terrain is very steep with little soil cover. Rainfall, and snow in the winter make-up the 20 to 30 inches of annual precipitation.



Ref: 35A

Figure 1. Natural provinces of southern California.



Ref: 35A

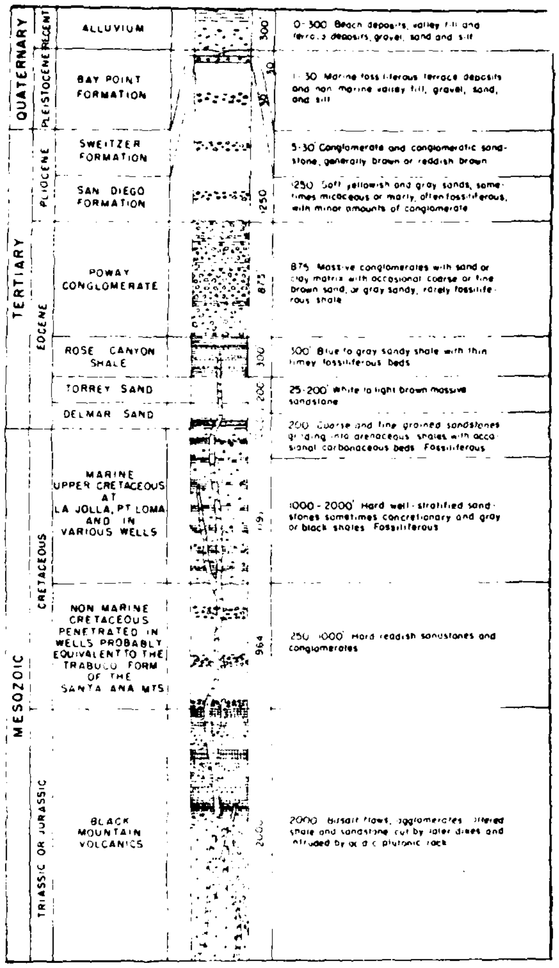
Figure 2. Peninsular Ranges Province.

1.9 The geology of the province consists of igneous rocks and metamorphic rocks that are found in the coastal foothills and mountains, and sedimentary rocks that make-up the coastal plain. The igneous rocks comprise as many as 25 separate igneous intrusives that occurred about 90 million years ago. Most of these rocks consist of fine grained rocks whose mineral content is similar to the types of minerals found in sand samples collected from the area's major rivers and creeks. The metamorphic rocks, which range in age from 300 to 150 million years, consist of slate, quartzite, and minor amounts of marble. The total thickness of these metamorphic rocks is more than 30,000 feet thick.

1.10 The sedimentary rocks which form the coastal plain and which are exposed along the coastal cliffs are about 4,000 feet thick. These rocks range in age from Late Cretaceous to Pleistocene. Almost all of these rocks were deposited in a marine environment. Most of these rocks contain a significant amount of sand sized material (see fig. 3). These above rocks have been faulted by major fault zones, including the Newport Inglewood, the Whittier-Elsinore and San Jacinto Fault zones.

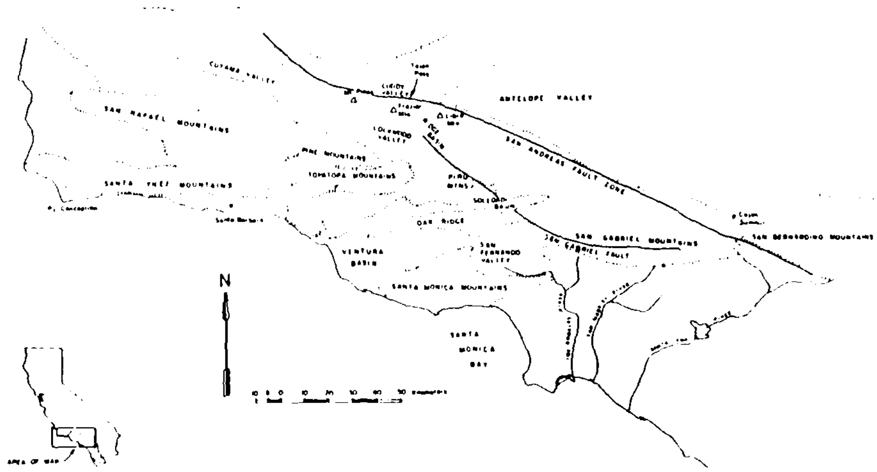
Transverse Range Province

1.11 The major morphologic features of the Transverse Range Province consist of the Santa Ynez, Santa Monica, San Gabriel Mountains and the Ventura Basin (see fig. 4). This province is bounded on the north by the northern edge of the Santa Ynez Mountains. The eastern and southern boundaries of this province area are, respectively, the San Gabriel and Santa Monica Mountains. The Ventura Basin is an elongate basin about 120 miles long and 20 to 40 miles



Ref: 48A

Figure 3. Generalized geologic column Peninsular Ranges Province.



Ref: 35A

Figure 4. Transverse Range Province.

wide. The adjacent mountains have considerable relief, with crests of 3,500 to 9,000 feet. The climate within this province varies from warm, subhumid in the lower elevations to cool and humid in the higher elevations. Mean annual precipitation varies from 12 inches to 40 inches per year.

1.12 The Western San Gabriel Mountains consists of schist, and granitc rocks (see fig. 5). The schistose rocks are usually fine grained, where as the granitic rocks are coarse grained. A relatively large number of different types of heavy minerals are found among these rock types.

1.13 The Santa Ynez and Santa Monica Mountains consist of thick sections of Quaternary and Tertiary rocks (see figs. 5 and 6). The rocks that potentially yield sand sized sediment include the Martinez, Domengine, Modelo, Repetto, Pico, along with Pleistocene formations. Geologic maps reviewed for this inventory suggest that the Modelo, Pico, and Pleistocene formations may be the most important produces of littoral zone sediment in the drainage basin.

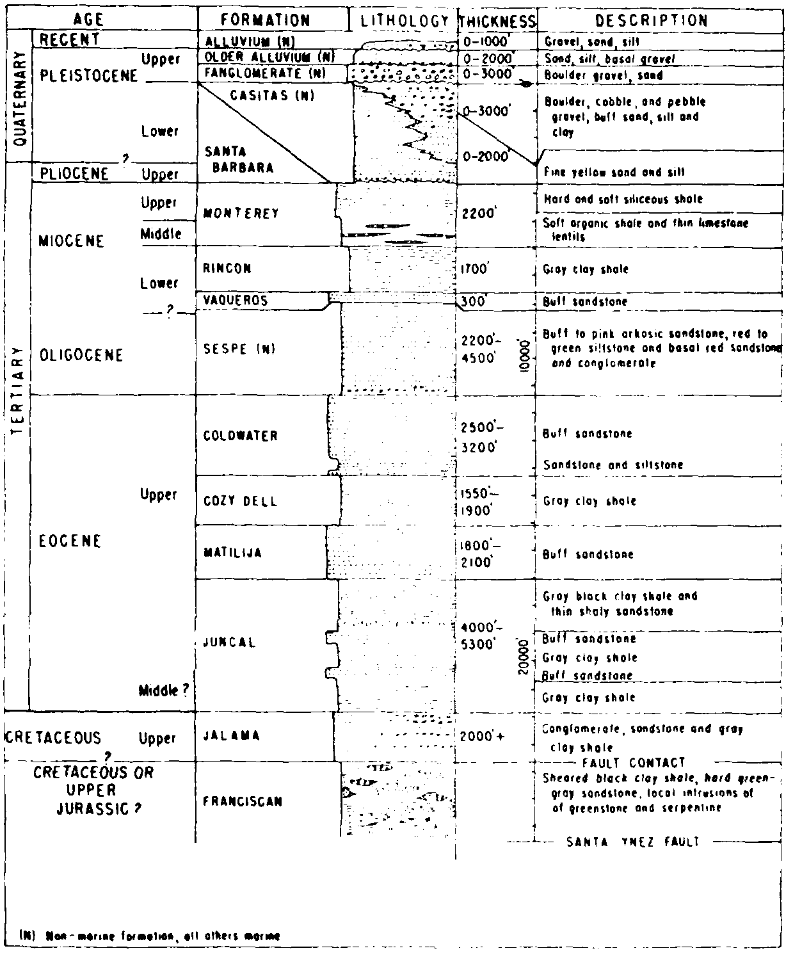
Coast Ranges Province

1.14 The Coast Ranges Province extends from Point Arguello on the south to the California Oregon border to the north (see fig. 1). In the Coast Ranges Province the northern limit of this report stops at at Cape San Martin. The overall morphology of this province consists of north west oriented ridges and vallies along with wide coastal plains which are located at the mouths of the Santa Ynez and Santa Maria Rivers. The mountains have an average elevation of 2000 feet. Almost half of the coastal plain located at both the Santa Ynez and Santa Maria Rivers have extensive dunes located landward of the beach.

	AGE	FORMATION OR MEMBER	LITHOLOGY	MAXIMUM THICKNESS (FEET)	DESCRIPTION
QUATERNARY	RECENT	Alluvium		1,000 +	Coarse sand, gravel, and boulders of San Fernando and Tujunga valleys.
QUATERNARY	UPPER PLEISTOCENE	Terrace deposits	Angular unconformity	200	Fanglomerate, stream terrace gravels, and older alluvium.
QUATERNARY	MIDDLE PLEISTOCENE	Pacoima fm	Angular unconformity	500 - 1,000	Brown-reddish-brown, poorly sorted conglomerate and fanglomerate; folded.
QUATERNARY	LOWER PLEISTOCENE	Saugus fm	Disconformity	6,400	Light-colored, poorly sorted, loosely consolidated non-marine conglomerate and coarse sandstone, fluviatile and alluvial-fan deposits.
TERTIARY	UPPER PLIOCENE	Pico formation: Upper Pico mbr; Sunshine Ranch mbr	Unconformity	(Upper Pico 300 ?) 3,000	Non-marine fluviatile, lacustrine, and brackish-water gray gravel, greenish-gray sandstone, sandy mudstone, conglomerate and thin freshwater limestone beds of Sunshine Ranch gradational, in part, into marine sandstone of Upper Pico mbr. in Placerita area and west of San Fernando Reservoir.
TERTIARY	MIDDLE PLIOCENE	Pico formation: Lower Pico mbr		700	Marine brownish sandstone, siltstone, and conglomerate; fossiliferous calcareous sandstone beds.
TERTIARY	LOWER PLIOCENE	Repetto fm: Repetto fm undiff		3,000	Marine coarse sandstone and conglomerate, marly shale, laminated gray and brown shaly sandstone, massive chocolate brown siltstone with carbon fragments, yellow jarosite (?) and gypsum.
TERTIARY	LOWER PLIOCENE	Repetto fm: Elsmere mbr	Unconformity	(Elsmere 1,400)	Marine conglomerate, gray and brown sandstone, massive gray and chocolate brown siltstone, silty shale and white arkose; base oil-saturated in Elsmere Canyon area.
TERTIARY	UPPER TO MIDDLE MIOCENE	Modelo fm	Disconformity	3,000	Marine fine to coarse arkosic sandstone and conglomerate, thinly bedded siliceous, calcareous, silty and diatomaceous shale.
TERTIARY	MIDDLE (?) TO LOWER (?) MIOCENE	Topanga (?) fm	Not in contact	1,000	Coarse reddish and yellowish arkosic sandstone, mudstone, conglomerate and a large proportion of vesicular basaltic flows and reddish-purple breccia, mostly near-shore or non-marine but top 2? feet marine in Pacoima Hills
TERTIARY	MIDDLE EOCENE	Domengine fm		650	Marine greenish-gray calcareous sandstone, coarse brown sandstone, and cobble conglomerate.
TERTIARY	LOWER EOCENE TO PALEOCENE	(Capay stage)		?	Subsurface in Whitney Canyon area.
TERTIARY	LOWER EOCENE TO PALEOCENE	(Meganos stage)		?	Subsurface in Whitney Canyon area.
TERTIARY	PALEOCENE	Martinez fm	Fault	1,500 +	Marine dark greenish-black to olive gray sandstone, thin interbeds of black shale. Thick massive well-cemented lenticular beds of pebble conglomerate. In San Gabriel fault zone.
CRETACEOUS (?) AND PRE-CRETACEOUS		Placerita and Diorite gneiss fms (Late Paleozoic) and intrusive granitic rocks	pm; dgn; gr	(Placerita 2,000±)	Crystalline limestone and dolomite, graphite and biotite schist, and quartzite of the Placerita fm (pm), associated with and intruded by dark quartz diorite gneiss, migmatites, and biotite schist (dgn), all intruded by Upper Jurassic (?)-Lower Cretaceous (?) granitic rocks (gr).

Ref: 27

Figure 5. Generalized geologic column of the Western San Gabriel and Santa Monica Mountains, Transverse Range Province.



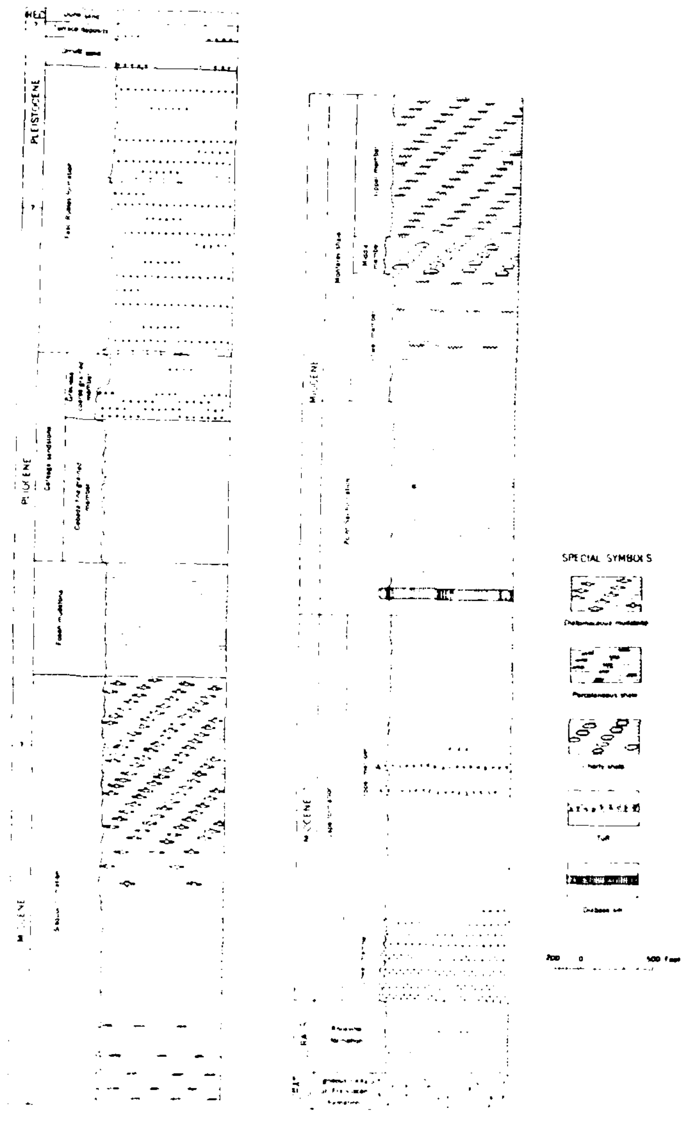
Ref: 27

Figure 6. Generalized geologic column of the Coastal Santa Ynez Mountainous, Transverse Range Province.

1.15 The climate of the Coast Ranges Province varies from humid and cool in the winter to dry and warm during the summer, especially in the inland valleys. Severe winter storms may cause considerable damage to manmade structures along the coastline. For example the winter storm of 1983 caused $1.5 million dollars of damage to the Morro Bay breakwaters, along with $600,000 in damage to the Port San Luis breakwater.

1.16 There are two major rock types in the Coast Ranges Province. The most widely exposed rock types are the Jurassic through Pleistocene sedimentary rocks. Those rocks consist of shales, mudstones, diatomaceous mudstones, sandstones and conglomerates of sedimentary age rocks (see fig. 7). The sedimentary rocks are mainly exposed in the coastal cliffs and drainage basins within the Santa Maria and Santa Ynez River. The more potentially important producers of sand sized sediment within those basins would be the Pliocene Carega sandstone and the Pleistocene Paso Robles Formation. Both of these rock units are exposed over large areas within the drainage basin, both rock units contain a very high percentage of sand sized sediment and both of these rock units are relatively easily eroded.

1.17 The other major rock type is the Franciscan Formation and associated granitic-like rocks (see fig. 8). This rock unit is hard, very dense, and although it may locally contain sand sized material, the rock is not easily eroded. The Franciscan Formation consists of interbedded sandstones, and shales, pillow basalts, along with metamorphosed volcanic rocks, and greenstones. Ultramafic rocks such as serpentine, and peridotite are also found in the Franciscan Formation.



Ref: 162A

Figure 7. Generalized geologic column of the Coast Range Province. Only rocks exposed in the in Santa Maria area and coastal San Luis Obispo county are shown.

Jf – Variety of rock types included in the assemblage No apparent stratigraphy or continuity within this area Locally Cretaceous rock are thrust over the Franciscan melange The Vaqueros and Lospe Formations were deposited on an irregular surface of Franciscan and Cretaceous rocks

Jfgw – Fresh graywacke is blue or greenish gray, weathered it is a yellowish-brown to grayish brown Typically medium-grained and not cross-bedded, quartz (40-60%), feldspar (15-25%), lithic fragments (10-30%), micrograywacke incl Jfv–Dark green to black basalt, pillow basalt well exposed at mouth of San Luis Creek Jfch–Red, green, brown, and white chert, red chert locally associated with blue schist, as isolated pods scattered over hillsides Jfsc –Blue and green schist, glaucophane schist is composed of quartz, chlorite, muscovite, and a minor amount of glaucophane Jfmv – Metamorphosed volcanic rocks including meta-basalts with obscure pillow structures and greenstone, greenstone consists chiefly of chlorite, albite, actinolite, and quartz Jfcg – Pebble conglomerate clasts of slate and chert in a sandy matrix Jfcly – Yellowish-brown to dark brown claystone, locally with chert pebbles

s – Serpentinite, gray, blue, red, brown, and green serpentinite and peridotite, massive with fibers of chrysolite, waxy appearance Peridotite consists of pyroxene (15%), olivine (75%), biotite (10%), some magnetite and chromite

Ref: 44

NOTE: All of the rock types shown in the graphic column belong to the Franciscan Formation.

Figure 8. Generalized geologic column of the Franciscan Formation, Coast Ranges Province.

DATA INVENTORY

Introduction

2.1 The data inventoried for this report consists of the following topics:

1. Coastal Geologic Features

   a. Stable - unstable landforms, which include dunes, headlands, cliffs, bluffs, slides.

   b. Offshore - bathymetric features, which include submarine canyons, offshore pinnacle rocks.

   c. Geological descriptions of river basins and drainage areas.

2. Sediments

   a. Sources - sinks, sources and sinks of beach material including beaches, cliffs, bluffs, canyons, and upland areas.

   b. Sediment characteristics, which includes mineralogy, texture, and stratigraphy.

3. Geologic Processes

   a. Erosion and deposition, the location and volume of material that has been eroded or deposited in the recent and historical time.

4. Landmass Changes

    a. Subsidence

    b. Emergence

    c. Tectonic Movements

5. Sand and Gravel Mining

    a. Quantities

    b. Impact on littoral sediment budget

2.2 Each of the topics is preceeded by a comments section, and reference numbers, for example ("Ref: 70") represent the source for the data posted on the inventory sheets. All of the references that were reviewed are listed in the reference section at the end of the report. A glossary is also located at the back of the report.

2.3 In addition to the inventory sheets, the data has also been posted on six plates. In the case of multiple sets of the same type of data in the same area, the data posted on the plates represents average values. The geographic coverage of the inventoried reports is also plotted on the appropriate plate.

2.4 Because this report is an inventory, the following list of technical issues are not addressed. These technical issues should be evaluated in the preparation of the Geomorphology Framework Reports.

(a) Incompatible laboratory test data from two or more reports that covered the same geographic area.

(b) The significance of the methodology of the sampling proceedure or the location where the original author(s) collected their data.

(c) The significance of the data in terms of the mechanics of transport, and the impact of seasonal changes, and storms.

Data Summary - Inventory Comments

Inventory Subject: Stable/Unstable Landforms

1. Although there are extensive dune fields north of Point Conception, the literature (Ref: 109A) indicates that a large portion of the dune fields may not be active, i.e. Flandrian dunes, or that the dune fields are stabilized due to being overgrown by shrubs, trees, or grasses.

2. Landslides are related to rainfall, bedrock geology, soil and vegetative development, along with topography. In the Santa Monica Mountains, soil slips are a very common form of landslide, whereas in the Palos Verdes area along the shoreline, there are extensive glide-block slides (Ref: 108). The coastal cliffs from San Onofre to Oceanside are almost entirely broken-up by very large block slides (Ref: 143D). Some references indicate that urbanization of the coastal drainage basin has effected coastal landslide activity (Ref: 135). Damage to manmade structures in the drainage basin has also shown how abundant landslides are in some coastal areas, for example, the Newport Bay to San Onofre area (Ref: 129).

3. The abbreviations L, M, H refer to the Low, Moderate and High concentration of landslides in the cell-reach. These designations were adapted from the original reference (Ref: 109A) and as such, the original reference indicated that the data shows regional trends in the abundance of landslides.

4. Explanation of inventory categories:

Dunes - Restricted to non-marine deposition of sand sized material landward of the beach.

Cliffs - Represents exposed consolidated sediments and/or rock.

Slides - Any movement of soil and/or rock, for the purposes of this report, the term is used in a very general sense.

Inventory Topic: Stable/Unstable Landforms

South Central Region

Sub Region VI

Morro Bay Cell

DUNES:

Shoreline extent: ± 25 percent of coastline.

Ref: 22 identifies dunes at three localities in this cell. These dune fields (Pt. Siena, Nevada, and Piedras Blancas) dune fields are active, and the sand"...travels across the flat (dune) and into the sea or onto the beach....". Area extent: ± 1% of coastline

At Morro Bay a large complex of Flandrian* dunes exists behind a narrow strip of beach front dunes of recent age. Much of inland dunes are urbanized (Ref: 22). Area extent: ± 25 percent of coastline.

CLIFFS:

Area extent: ± 50 percent does not include narrow sandy beaches backed by cliffs.

Mean cliff height 30 to 120 feet. Ref: 50.

SLIDES:

Estimated relative amounts of landslides.

Low: 10 percent

Moderate: 80 percent

High: 10 percent   Ref: 109A.

* See Glossary

Inventory Topic: Stable/Unstable Landforms

South Central Region

Subregion VI

Santa Maria River Cell

DUNES: Shoreline extent: 100 percent

One large dune field occupies the entire cell (Ref: 22). Dunes consist of two separate dune complexes, each complex consisting mostly of older Flandrian dunes inland with younger, (?) active dunes along the shoreline. Landward migration of older dunes was identified on air photos taken in 1930 and in 1949 (Ref: 22); however, recent data indicates that the dunes are stabilized by vegetative cover (Ref: 30). Much of the dune field is not urbanized.

CLIFFS:

Area extent: none Ref: 50

SLIDES:

Estimated relative amounts of landslides:

Low: 60 percent

Moderate: 40 percent

High: 0 percent Ref: 109A

Inventory Topic: Stable/Unstable Landforms

South Central Region

Subregion VI

Santa Ynez River Cell

DUNES: Shoreline extent: 70 percent Ref: 22.

One large dune field occupies most of the coastline (localities 20 and 21, Ref: 22). No information on recent dune activity.

CLIFFS:

Area extent: 30 percent

Low rocky cliffs, overtopped by high wave conditions. Ref: 50

SLIDES:

Estimated relative amount of landslide

Low: 60 percent

Moderate: 40 percent

High: 0 percent Ref: 109A

Inventory Topic: Stable/Unstable Landforms

South Central Region

Sub Region VII

Santa Barbara Cell

DUNES: Shoreline extent: 10 percent of the coastline

Two dune areas have been mapped, a very small dune complex at Pt. Conception, and at a large dune complex downcoast of the mouth of the Santa Clara River. (Locations 22 and 24, Ref: 22). The dunes at Pt. Conception are located at the top of a 120-foot-high cliff, and the description given suggests non-aeolian origin. The dunes downcoast of the Santa Clara River may not be of aeolian origin. Ref: 22.

CLIFFS: Area extent: none

SLIDES:

Estimated relative amounts of landslides:

Low:	30 percent	
Moderate:	20 percent	
High:	50 percent	Ref: 109A

Putnam (Ref: 109) stated that "landslides are conspicuous features and are important agents of transportation" in the coastal hills in the Ventura area.

Inventory Topic: Stable/Unstable Landforms

South Coast Region

Sub Region VIII

Santa Monica Cell - Santa Monica Beach

DUNES: Shoreline extent: 20 percent of the cell; Ref: 50

A large dune complex exists from Ballona Creek to King Harbor. These dunes, which are locally known as the El Segundo Sand Hills are located landward of a 15 to 50-foot-high bluff that backs the area's beachs. Evidence exists that this very large dune complex in very old (? Pre-Flandrian, Ref: 22). The dunes are covered by extensive urbanization.

CLIFFS:

Area extent: See above.

SLIDES:

Estimated relative amounts of landslides:

Low:	80 percent	highly urbanized area
Moderate:	10 percent	
High:	10 percent	Ref: 109A

Inventory Topic: Stable/Unstable Landforms

South Coast Region

Sub Region IX.

San Pedro Cell - San Pedro Reach

DUNES: Shoreline extent: none. (Ref: 22).

CLIFFS:

Area extent: about 30 percent of the coastline is cliffed.

The cliffed reach of the cell extends from Newport Beach southward to Dana Point. The cliffs range in height from 70 to 180 feet. Ref: 50.

SLIDES:

Estimated relative amounts of landslides:

Low: 70 percent

Moderate: 5 percent

High: 25 percent Ref: 109A.

Inventory Topic: Stable/Unstable Landforms

San Diego Region

Sub Region X.

Oceanside Cell - Oceanside Reach

DUNES: Shoreline extent: one percent

One locality has been identified, near the mouth of the San Dieguito River, about 9 miles north of La Jolla. The dunes are located on top of a 30-foot-high cliff. Ref: 109A.

CLIFFS: Area extent: 95 percent

The entire shoreline of this cell has cliffs, except for the mouths of the larger rivers in the area. The cliffs range in height from 30 to 300 feet. Ref: 50.

SLIDES:

Estimated relative amounts of landslides:

Low:	80 percent	
Moderate:	10 percent	
High:	10 percent	Ref: 109A

Inventory Topic: Stable/Unstable Landforms

San Diego Region

Sub Region X.

Mission Beach Cell - Mission Beach Reach

DUNES: Shoreline extent: none Ref: 109A.

CLIFFS: Shoreline extent: 60 percent.

Cliffs range in height from 20 to 100 feet. Ref: 50.

SLIDES: Estimated relative amounts of landslides

Low: 90 percent

Moderate: 5 percent

High: 5 percent Ref: 109A

Inventory Topic: Stable/Unstable Landforms

San Diego Region

Sub Region X.

Silver Strand Cell-Reach

DUNES: Shoreline extent: 15 percent

The dunes, which are not very extensive, are located in the area south of the mouth of the Tijuana River. Ref: 50.

CLIIFS: Shoreline extent: None.

SLIDES:

Estimated relative amounts of landslides.

Low: 90 percent

Moderate: 5 percent

High: 5 percent Ref: 109A

Inventory Subject: Data Summary Inventory Comments - Offshore Bathymetric Features

1. Rocky areas should be mapped at a scale of 1" = 2000' in order to properly select rangeline locations.

2. Rocky areas are present in many areas within the littoral zone or the nearshore zone.

3. Some references (Ref: 25) indicated that the submarine canyons may have originated by tectonic activity within recent geologic time.

4. Submarine canyons don't have the same type morphology that associated onshore drainages have (Ref: 25).

5. Explanation of inventory categories:

Rocks (Nearshore Morphology) - The littoral zone consists of exposed rocks for most of the year. Offshore rocks and pinnicles are included in this category.

Sand (Nearshore Morphology) - The littoral zone consist of sand sized material for most of the year.

Inventory Topic: Offshore Bathymetric Features

Region: South Central

Sub Region: VI

Cell - Reach: Morro Bay Cell - S. Morro Bay Reach

SUBMARINE CANYONS

1 - Four small scale canyons (in S. Point Sur Reach) located off shore of the Cape San Martin - Pt. Piedras Blancas Area. None of the canyons have fans at their base.

2 - E-W trending canyon near Pt. Piedras Blancas may come with in 1 mile of the coastline. There is no evidence of a fan at the base of the canyon. Ref: Hydro C. 18700*.

Canyon(s) Active: No published information.

NEAR SHORE MORPHOLOGY

Percent of rocky coastline: 80 percent	Most rock outcrops are Cretaceous age interbedded sandstones and shales.
Percent of sandy-beach coastline: 20 percent	Morro Bay (tower) south for 5 miles. Ref: 156

*U.S. Coast and Geodetic Survey Chart 18700

Inventory Topic: Offshore Bathymetrice Features

Region: South Central

Sub Region: IX

Cell - Reach: Santa Ynez, River Cell

SUBMARINE CANYONS

1 - Arguello Canyon, a very large canyon system which has more than 900 feet of hydrographic relief, extends to with 2 to 3 miles of the surf zone. The canyon's fan is very large, covering a 20 by 20 mile area many miles offshore. Ref: 25. C & GS 18720*

Canyon(s) Active:

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 10 percent — Most of the rock types are Miocene and younger sedimentary rocks.

Percent of sandy-beach coastline: 90 percent — Ref: 156.

*U.S. Coast and Geogetic Survey Chart 18720

Inventory Topic: Offshore Bathymetrice Features

Region: South Central

Sub Region: VI

Cell - Reach: Santa Maria Cell - Santa Maria Reach

SUBMARINE CANYONS

None — Ref: 25 and C & GS 18700*

Canyon(s) Active: N/A

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 20 percent — Most of the exposed rocky areas consist of very hard, fine grained Franciscan Formation rocks and some volcanic rocks.

Percent of sandy-beach coastline: 80 percent — Ref: 156

*U.S. Coast and Geodetic Survey Chart 18700

Inventory Topic: Offshore Bathymetrice Features

Region: South Central

Sub Region: VII

Cell - Reach: Santa Barbara Cell - Santa Barbara Reach

SUBMARINE CANYONS

1 - Point Conception submarine canyon ties into the Pt. Arguello submarine canyon 30 to 40 miles offshore. This canyon system comes to within 3 to 4 miles of the littoral zone. Ref: 25, C & GS (18700)*.

2 - Hueneme Submarine Canyon. Both canyons lie within the littoral zone and both canyons have asymmeteric profiles. Both canyons feed into a moderately large submarine fan complex located at the extreme north edge of the Santa Monica Basin.

3 - Mugu Submarine Canyon

Canyon(s) Active: Hueneme and Mugu Ref: 25 C & GS 18720.

Active(?): Pt. Conception C & GS 18720.

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 30 percent	Most exposures are of the Monterey Formation, a locally sandy mudstone-diatomite shale.
Percent of sandy-beach coastline: 70 percent	Oxnard beaches are free of exposed rock. Ref: 156.

* U.S. Coast and Geodetic Survey Chart 18700

Inventory Topic: Offshore Bathymetrice Features

Region: South Central

Sub Region: VIII

Cell - Reach: Santa Monica Cell - Santa Monica Reach

SUBMARINE CANYONS

1 - Dune Submarine Canyon comes to within 1,000 feet of the shoreline.

2 - Santa Monica Submarine Canyon comes no closer than 4 miles of the shoreline.

3 - Redondo Submarine Canyon comes within 1,000 feet of the shoreline. Ref: C & GS 18740*.

Canyon(s) Active: Redondo Canyon

Active(?): Dume, Santa Monica Canyons

(Ref: 45, 46)

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 40 percent — Most of rock exposed consists of interbedded sandstones, and shale of Monterey Formation.

Percent of sandy-beach coastline: 60 percent — Ref: 156.

*U.S. Coast and Geodetic Survey Chart 18740

Inventory Topic: Offshore Bathymetrice Features

Region: South Central

Sub Region: IX

Cell - Reach: San Pedro Cell - San Pedro Reach

SUBMARINE CANYONS

1 - San Pedro Submarine Canyon is located 3 miles from the shoreline on the outter edge of the San Pedro shelf.

2 - San Gabriel Submarine Canyon is located 5 miles from the shoreline on the outter edge of the San Pedro shelf.

3 - Newport Submarine Canyon is located about 1,000 feet from the shoreline. Ref: C & GS 18740*.

Canyon(s) Active: Newport

Active(?): San Pedro and San Gabriel

Ref: 25

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 15 percent

Most of the outcrop rocks consist of either interbedded sandstones and shales (Monterey Formation) or volcanic rocks.

Percent of sandy-beach coastline: 85 percent

Ref: 156

*U.S. Coast and Geodetic Survey Chart 18740

Inventory Topic: Offshore Bathymetrice Features

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside Cell - Oceanside Reach

SUBMARINE CANYONS

1 - Santa Margarita Canyon is located 4 miles from the shoreline, there is a large fan at base.

2 - Agua Hedionda Canyon is located less than a mile from the shoreline, there is a large fan at base.

3 - La Jolla - Scripp Canyon is located less than 5 miles from the shoreline, there is a large fan at base.

Ref: 25

Ref: (C & GS 18740)

Canyon(s) Active: La Jolla- Scripp Canyon

Active(?): Agua Hedionda Canyon — Ref: 25

Not active(?): Santa Margarita, Canyon

NEAR SHORF !'ORPHOLOGY

Percent of rock coastline: 50 percent — Most outcrop rocks are Eocene age sandstones, mudstones, and some interbedded sandstones and shales.

Percent of sandy-beach coastline: 50 percent — Ref: 156

*U.S. Coast and Geodetic Survey Chart 18740

Inventory Topic: Offshore Bathymetrice Features

Region: San Diego

Sub Region: X

Cell - Reach: Mission Bay Cell - Mission Bay Reach

SUBMARINE CANYONS

None

Canyon(s) Active: N/A

NEAR SHORE MORPHOLOGY

Percent of rock coastline: 60 percent	Exposed rocks are mostly Cretaceous age inter-bedded sandstones and shales.
Percent of sandy-beach coastline: 40 percent	Ref: 156

Inventory Topic: Offshore Bathymetrice Features

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand Cell - Silver Strand Reach

SUBMARINE CANYONS

1 - Coronado Canyon is located 6.5 miles from the shoreline, there is a large fan at base of the canyon Ref: (C & GS 18700)*

Canyon(s) Active:

Active(?): Coronado Canyon Ref: 25

NEAR SHORE MORPHOLOGY

Percent of rock coastline: none

Percent of sandy-beach coastline: 100 percent Ref: 156

OTHER FEATURES:

1 - Zuniga Submarine Fan, which is located along and seaward of Zuniga Jetty, is relatively large in relationship to the cell. It represents about 25 percent of the near shore area adjacent to the cell.

*U.S. Coast and Geodetic Survey Chart 18700

Data Summary - Inventory Comments

Inventory Subject: Descriptive Geology - Drainage Basins

1. The major objectives of an inventory of the descriptive geology of any Region is the identification of the major drainage basins along with their geomorphic classification, the availability of geologic data on the lithology of the basin, and any published data on the volume of sediment eroded in the watershed.

2. The published geologic maps for each regional river basin are adequate in terms of showing the distribution of rocks and soils that produce sand-sized material that is potentially available for fluvial transport to the littoral zone. However, the potential volume of sand-sized material, or the rate of production of sand-sized material is not available for the rocks and soils in all of the drainage basins.

3. The sediment production figures for subregions VII through X are for the total drainage area (both upstream and downstream of any existing dams). The figures given for basin sediment production represent gross estimated values.

4. The reference used to locate and inventory flood control features in this report may not represent a completely accurate inventory of flood-drainage structures; therefore, the information on drainage control features is furnished for planning purposes only.

5. An explanation of the Geomorphic Classification shown on plate 2 follows. The phrase "path of travel" refers to the distance sediment would travel from its source terrain in the basin to the littoral zone.

Abbreviation	Meaning	
CF	Coastal Foothills	Moderate relief, relatively short path of travel.
CM	Coastal Mountains	Relatively great relief, relatively short path of travel.
CP	Coastal Plain	Low relief, relatively short path of travel.
IV	Inland Valley	Low relief, relatively short path of travel.
IM	Inland Mountain	Relatively great relief, relatively long path of travel.

6. The Geologic Index values shown on plate 2, refer to the relative complexity of the geologic formations, or soils that could potentially furnish sediment to the littoral zone. An increasing numeric value represents increasing estimated complexity. The complexity scale ranges from 1 (simple) to 5 (very complex). The low values of complexity indicates a relatively low number of soil or rock types, each of which is characterized by a one or two different textural or petrographic types. The high values of complexity indicates that the soil or rock types can be characterized by several different textural or petrographic types.

7. Existing topographic and geologic maps which were at a scale of 1:250,000 and 1:2,400 were used to inventory the data, listed under "Geomorphic Classification" and under "Geologic Index." The topographic maps were also used to inventory the major drainages and the major drainage control features listed in this inventory.

8. The basin production values are in units of 1,000 cubic yards per year.

Inventory Topic: Descriptive Geology - Drainage Basins

South Central Region

Sub Region VI

Morro Bay Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal Santa Lucia	Adequate		Most drainages are moderate sized coastal streams and creeks

Five to six moderate sized streams potentially feed sediments to the beach (Atascadero and Morro Bay State Beaches).

Major drainage control feature: Whale Rock Reservoir.

Inventory Topic: Descriptive Geology - Drainage Basin

South Central Region

Sub Region VI

Santa Maria River Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal Santa Lucia	Adequate		Most drainages are moderate sized coastal streams and creeks.

Four moderate-sized streams potentially supply sediments to the beach (San Luis Obispo Creek, Pismo Creek and Arroyo Grande Creek).

Major drainage control feature: Lopez Lake

1-Santa Maria	Adequate		Only one major river

The major drainage in this river basin is the Santa Maria River, which is in turn fed by the Cuyama River, Tepusquet Creek, La Brea Creek, Sisquoc River and Foxen Creek.

Major drainage control feature: Twitchell Reservoir (on Cuyama River).

Inventory Topic: Descriptive Geology - Drainage Basins

South Central Region

Sub Region VI

Santa Ynez River Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-San Antonio	Adequate		One moderate sized creek

The single major drainage feature is San Antonio Creek.

Major drainage control features: None.

2-Santa Inez	Adequate		One major river

The single major drainage feature is Santa Ynez River, which is fed by seven major-sized creeks (Salsupuedes, El Jaro, Santa Rosa, Zaca, Nojaqui, Alamo Pintado, and Quiota Creeks).

Major drainage control features: Lake Cachuma

3-Coastal Santa Ynez Mts.	Adequate		Several moderate to small sized creeks and streams

The largest potential source for sediment is La Honda Canyon.

Major drainage control features: none.

Inventory Topic: Descriptive Geology - Drainage Basins

South Central Region

Sub Region VII

Santa Barbara Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal Santa Ynez Mts.	Adequate	870,000 cu. yds./yr. Coastal plains-foothills West of Ventura. 600,000 cu.yds./yr. Ventura River Basin Ref: 137B	Many short creeks, one major river.

The major drainage features are Gaviota Canyon Creek, the Ventura River, and Matilija Creek.

Major drainage control feature: Lake Casitas (Ventura River) Matilija Dam, and Glen Annie Reservoir.

2-Santa Clara	Adequate	4,000,000 cu. yds./yr. Ref: 137A	One large regional river basin fed by eight major creeks.

The major drainage feature is the Santa Clara River which is fed by Santa Paula, Sespe, Blanca, Castic, Bouquet, Mint Soledad, and Newhall Creeks.

Drainage control features: Santa Felicia Dam (Piru Creek), Pyramid Lake (Piru Creek), Castic Lake (Castic Creek), Bouquet Reservoir (Bouquet Creek).

3-Calleguas Creek	Adequate	220,000 cu. yds./yr. Ref: 137B	A moderate size basin with one main drainage having two feeder creeks.

The feeder creeks are Conejo, Arroyo Conejo, and Arroyo Simi.

Major drainage control features: none.

4-Coastal Santa Monica Mts.	Adequate	27,000 cu. yds./yr. Ref: 137B	Several short creeks, three moderate-sized creeks.

The three moderate-sized creeks are Sycamore, Little Sycamore, and La Jolla Canyon Creeks.

Major drainage control features: none.

Inventory Topic: Descriptive Geology - Drainage Basins

South Coast Region

Sub Region VIII

Santa Monica Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal Santa Monica Mts.	Adequate	340,000 cu. yds./yr. Ref: 137B	Three small-sized coastal hills drainages.

The major drainage features include Sycamore, Little Sycamore Creek, and La Jolla Valley Creek.

Major drainage control features: None.

Inventory Topic: Descriptive Geology - Drainage Basins

South Coast Region

Sub Region IX

San Pedro Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Los Angeles River	Adequate	1,800,000 cu.yd./yr. Ref: 137B	Large inland mountain drainage, with several large-scale creeks or rivers feeding into the main drainage.

The Los Angeles River is the basin's major drainage feature, which is fed by five major streams or creeks, which include Pacoima Creek, Tujunga Wash, Devil Creek, Bull Creek, Arroyo Seco, and Rio Hondo.

Major drainage control features: There are at least four major dams: Sepulveda, Hansen, Whittier Narrows, and Santa Fe Dams, together with more than twelve other smaller dams and reservoirs.

2-San Gabriel River	Adequate	380,000 cu. yds./yr. Ref: 137B	Large inland-mountain drainage, with several large creeks or rivers feeding into the major drainage.

The major drainage feature is the San Gabriel River which is feed by Coyote Creek, Big and Little Dalton, San Dimas, and Walnut Creeks.

Major drainage control features: Whittier Narrows, Santa Fe Dams.

3-Santa Ana River	Adequate	2,240,000 cu. yds./yr. Ref: 137B	Large inland mountain-and-valley drainage fed by several large creeks.

The main drainage feature is the Santa Ana River, which is fed by at least a dozen major creeks or washes that include: Santiago, Temescal, Chino, San Andiamo, Cucamonga, Dry, Lytle, Warm, and San Timates Creeks.

Major drainage control features: There are eight major reservoirs in this drainage basin: Prado, Irvine Lake, Elsinore, Lake Mathews, Big Bear Lake, San Antonio, Railroad Canyon, and Hemet.

Inventory Topic: Descriptive Geology - Drainage Basins

San Diego Region

Sub Region X

Oceanside Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal Santa Ana Mountains	Adequate	720,000 cu. yds./yr. Ref: 137B	Moderate-sized coastal-foothill drainages.

The larger drainages include: San Mateo, San Onofre, and Las Flores Creeks.

Major drainage control features: None.

2-Santa Margarita River	Adequate	790,000 cu. yds./yr. Ref: 137B	Moderate-sized coastal mountain drainage.

Major drainage control feature(s): Vial, and Skinner Lakes.

3-San Luis Rey River	Adequate	790,00 cu. yds./yr. Ref: 137B	Moderate sized coastal mountain drainage.

Major drainage control feature: Lake Henshaw.

4-Coastal San Diego	Adequate	560,000 cu. yds./yr. Ref: 137B	Several coastal plains-coastal mountain rivers and creeks.

Major drainage control features: Lake Wohlford, Lake Hodges, and Lake Sutherland.

Inventory Topic: Descriptive Geology - Drainage Basins

San Diego Region

Sub Region X

Mission Beach Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-Coastal San Diego	Adequate	380,000 cu. yds./yr. Ref: 137B	Moderate-sized coastal mountain drainage.

Major drainage control features: San Vicente Reservoir, El Capitan Lake, and Lake Cuyamaca.

Inventory Topic: Descriptive Geology - Drainage Basins

San Diego Region

Sub Region X

Silver Strand Beach Cell-Reach

Regional River Basin	Published Geology	Published Analysis Sed Product	Geomorphic Classification
1-San Diego Coastal Streams (south)	Adequate	430,000 cu. yds./yr. Ref: 137B	Moderate-size coastal mountain drainages.

There are only two drainages: Sweetwater Reservoir and Dulzura Creek.

Major drainage control features: Sweetwater Reservoir Lowland Reservoir, and Lower Otay Reservoir.

2-Tijuana River	Adequate	1,650,000 cu. yds./yr. Ref: 137B	Large-sized coastal mountain drainage with at least six major creeks that flow into the main river.

Major drainage control features: Barrett, Morena, and Rodriquez Reservoirs.

Data Summary - Inventory Comments

Inventory Subject: Sediments - Sources and Sinks

1. The size of a source terrian, or sink is made according to the following classification. The estimate of size was based on existing 1:250,000 and 1:2,400 scale topographic maps.

Classification	Size (Sq. Miles)
Very Small	Less than 50
Small	50 to 100
Medium	100 to 500
Large	500 to 2000
Very Large	Greater than 2000

2. The distribution of sediments cited in Ref: 125, 132, 164 is based on widely scattered sample points that may not accurately define the texture-petrology of the sediment source or sink.

3. The abbreviations shown on plate 4 which are used to described the sediment texture are as follows:

Abbreviation	Meaning
M	Median diameter, mm.
MØ	Median phi diameter

3. (cont't.)

Abbreviation	Meaning
S	Sorting
SØ	Phi Sorting
Sk	Skewness
SkØ	Phi Skewness
KØ	Phi Kurtosis

4. The abbreviations shown on plate 4 which are used to described the sediment petrology are as follows:

Abbreviations	Meaning
P	Plagioclase
PF	Potassium Feldspar
HM	Heavy Mineral
A	Allanite
B	Biotite
E	Epidote
G	Garnet
H	Hornblende

Abbreviation	Meaning
I	Ilmenite
I	Igneous Rocks
M	Metamorphic Rocks
MQz	Monocrystaline Quartz. Monocrystaline quartz grains consist of a single quartz crystal.
PQz	Polycrystaline Quartz. A polycrystaline quartz grain consist of two or more quartz crystals.
S	Sphene
T	Titanite
TO	Tourmaline
V	Volcanic Rocks
Z	Zoisite

5. The minerals listed under Petrology indicates some of the more common species of minerals found in the coastal environment as indicated in the literature. These minerals may or may not be diagnostic of a particular source or any specific path of travel, unless otherwise specifically stated.

6. Geologic data (Ref: 163) indicates that the recent fluvial sediment in the Santa Maria River bed is no more than 100 feet thick near the mouth of the river.

Data Summary - Inventory Comments

Inventory Subject: Sediments

7. The assignment of the study area's major rivers and creeks to the "Sediment Sink" category is based on one reference, (Ref: 137B). The other literature reviewed for this inventory did not indicate that the area's major rivers were sinks for beach sediment. In order to prepair a future Plan of Study to meet the worst case situation, it was decided to treat the study area's fluvial systems as sinks.

8. It has been stated in the literature that the effect of dams, which act as a trap for fluvial sediment, will be more easily determined for the Ventura River, than for the Los Angeles, San Gabriel, and Santa Ana River. Ref: 12.

9. Some of the published data on the amount of sediment available down stream of a dam in any given river basin may represent the minimum effect dams may have on sediment supply to the littoral zone. Norris (Ref: 97) indicates that dams are located so that the area downstream of the dam is usually within the coastal plan. The ability of the river to transport sediment to the littoral zone is therefore reduced due to the relatively low gradient of the river downstream of the dam, and to the retension of high flows by the dam.

10. Benthic foraminifera have been used to identify nearshore sediment that has been transported offshore. Approximately 44 species were used to identify nearshore, nearshore-central shelf, outer shelf, and deep basin type sediments (Ref: 121).

11. It has been reported (Ref: 42) that significant sediment transport of littoral zone material between the Santa Barbara and Santa Monica cells does occur.

12. Abalone Cove Beach, Palos Verdes Peninsula (Santa Monica Cell) is a man made beach; all of the beach sand was imported from a distant quarry. Ref: 111.

13. Descriptions and locations of rocks collected from submarine canyons and from the continental shelf indicates that there are submarine exposures of the same type of rocks that are exposed in the adjacent on-shore areas in southern California. Ref: 34.

14. The types of heavy minerals collected from a beach may be quite different from than from an adjacent river. Ref: 42.

15. Sediment transport down a submarine canyon may not be identified solely on the basis of texture data. Ref: 74.

16. Although there is some detailed information on the erosion of the coastal cliffs at a few select sites south of Dana Point, there is little or no information on the processes of cliff erosion north of Dana Point.

17. Natural mixing of different types of sediments in a lake may not occur due to the lack of strong waves and currents. At Lake Elsinore for example, the perimeter of the lake can be subdivided into the separate areas, each of which has its own type of sediment. The texture and the mineralogy of each area is strongly influenced by the geology of the rocks along the adjacent shoreline. The mineralogy and the associated geology of the shoreline at Lake Elsinore can be subdivided into three groups as follows:

Mineral Group	Associated Geology
Group A	
Hornblende	Intermediate Plutonic Rocks
Hypersthene	
Chlorite	
Epidote	
Diopside	
Apatite	
Topaz	
Zircon	
Group B	
Same as Group "A"	Metamorphic Rock
Plus,	
Andalusite	
Kyanite	
Garnet	
Group "C"	
Same as group "B"	Pegmatites
Plus	
Monazite	
Tourmaline	
Cassiterite	Ref: 82

18. Laboratory tests on the rate of wear of sand from Huntington Beach indicate that rounded grains have been shaped by more than one cycle of erosion, transport, and deposition. Ref: 1

19. It has been stated (Ref: 16) that Newport Canyon is inactive.

20. Grant (Ref. 42A) has described six different types of sediments on the San Pedro Shelf. The most significant type of sediment is the material he referred to as Group III. The Group III sediments consisted of fine grained, poorly sorted sands and silts that extend from the shoreline seaward across the width of the shelf. Grant also stated that surface sediments are being modified in water as deep as 300 feet.

21. Moore (Ref. 89) described seven different types of sediments on the San Pedro Shelf. Moore found that a relatively large section of the shelf, which extended seaward from the littoral zone to the San Pedro Escarpment consisted of very fine to medium grained sands.

22. Recent texture and petrologic data show that there are significant differences in texture and mineralogy in the area covered by the data inventoried during the course of this report. Therefore, the data shown in this report represents an overall average range of values for texture and petrologic data. It should also be stressed that only a few reports presented data that indicated what sedimentologic changes occurred between samples collected during the oceanographic winter and summer seasons. Therefore, any sediment sampling plan based on the inventoried data should be considered preliminary.

Inventory Topic: Sources and Sinks

Region: South Central

Sub Region: VI

Cell - Reach: Morro Bay

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume of Rate
Drainage Basin(s)			
Cliffs			

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Dune Morro Bay Dunes	Small 8 sq. mi.	100% "Sand" sized	
Lagoon			
Cont. Shelf	Medium	±50% Ref: 156	
Submarine Canyon-Fan			

Inventory Topic: Sources and Sinks

Region: South Central

Sub Region: VII

Cell - Reach: Santa Maria

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Santa Maria (see note 5)	Small		460,000 cu.yd./yr. Ref: 66
San Antonio Creek (see note 5)	Small		14,000 cu.yd./yr. Ref: 66
Cliffs			

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Santa Maria River	Small ± 100' thick		
Dune			
Callendar Guadalupe Musul Rock	Small 50 sq. miles Total	100 %	151,000 cu.yd./yr Ref: 66
Lagoon			
Cont. Shelf	Small	± 50% Ref: 156	
Submarine Canyon-Fan			

Inventory Topic: Sources and Sinks

Region: South Central

Sub Region: VI

Cell - Reach: Santa Ynez

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Santa Ynez River (See note 5)	Large		48,000 cu. yds./yr. Ref: 66
Honda Ck (See note 5)	Small		7,000 cu. yds./yr. Ref: 66
Cliffs			

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
See above in "Drainage Basins"			
Dune Purisima Point	Small	100%	55,000 cu. yds./yr Ref: 66
Santa Ynez River			
Lagoon			
Cont. Shelf	Small	± 50% Ref: 156	
Submarine Canyon-Fan	Small	±50% Ref: 156	

Inventory Topic: Sources and Sinks

Region: South Central

Sub Region: VII

Cell - Reach: Santa Barbara

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Cliffs			
Pt. Arguello	Small		25,000 cu. yds./yr. Ref: 66

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Ventura	Small		Unk (see note 6)
Dune			
Buenaventura State Beach	Small	±100%	200,000 cu. yds./yr.
Mandalay Beach	Small	±100%	400,000 cu. yds./yr. Ref: 142
Lagoon			
Cont. Shelf			
Pt. Arguello-Santa Barbara	Very Small	±50%	
Santa Barbara-Solomar	Small	±30% Ref: 156	
Submarine Canyon-Fan			

Inventory Topic: Sources and Sinks

Region: South Coast

Sub Region: VIII

Cell - Reach: Santa Monica

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Cliffs			

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Dune	Small (?) Active		
Lagoon			
Cont. Shelf	Small	±50% Ref: 156	
Submarine Canyon-Fan			
Dune Redondo	Small Small		

Inventory Topic: Sources and Sinks

Region: South Coast

Sub Region: IX

Cell - Reach: San Pedro

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Cliffs			
San Clemente	Small	70-80% Ref: 158, 86	

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Dune			
Lagoon			
Cont. Shelf	Small	±80% Ref: 156	
Submarine Canyon-Fan			
Newport Canyon	Small	see note 18	

Inventory Topic: Sources and Sinks

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
Drainage Basin(s)			
Santa Margarita	Large		
San Luis Rey	Large		
Cliffs			
Dana Pt. to San Onofre	Small		
San Onofre to Oceanside	Small		
Oceanside to La Jolla	Small		

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Santa Margarita	Large		
San Luis Rey	Large		
Dune			
Lagoon			
Santa Margarita	Small		
Agua Hediondo	Small		
Batiquitos	Small		
Los Perasquitos	Small		
Cont. Shelf		±50% Ref: 156	
Submarine Canyon-Fan			
La Jolla	Small		

Inventory Topic: Sources and Sinks

Region: San Diego

Sub Region: X

Cell - Reach: Mission Bay

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume of Rate
Drainage Basin(s)			
San Diego River	Medium		
Cliffs			
Point Loma	Small	±30% Ref: 120	

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume of Rate
River(s)			
Dune			
Lagoon			
Mission Bay	Small		
Cont. Shelf	Small	±50% Ref: 156	
Submarine Canyon-Fan			

Inventory Topic: Sources and Sinks

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand

SEDIMENT SOURCE Area	Relative Size	Percent Sand Sized Sediment	Volume of Rate
Drainage Basin(s)			
Cliffs			

SEDIMENT SINK Area	Relative Size	Percent Sand Sized Sediment	Volume or Rate
River(s)			
Dune	Very Small		
Lagoon	Very Small		
Cont. Shelf	Small	±80% Ref: 156	
Submarine Canyon-Fan Coronado	Small		(?) Active Ref: 25

Inventory Topic: Sediment Characteristcs

Region: South Central

Sub Region: VI

Cell - Reach: Morro Bay

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type	Petrology			
Drainage Basin(s)						
Coast Ranges (in general)		Epidote Sphene Garnet Allanite Ref: 132				
Santa Lucia Mts.		Hornblende - Garnet Ref: 164				
River(s)						
Cliffs						
Lagoon(s)						
Beach Morro Bay State Beach	2.74 MØ 2.4 SØ -0.4 SKØ Ref: 125					
		Heavy Minerals*: 50-70% Ref: 56A				
		Epidote	Augite	Hornblende	Chlorite	Opaques
San Simeon	0.7 to 1.2 MØ	2.4	4.0	0.3	5	70
Atascadero	2.30 MØ	30.2	17	5	3	26

*Percentages of selected species are given.

Inventory Topic: Sediment Characteristics

Region: South Central

Sub Region: VI

Cell - Reach: Morro Bay (Continued)

SEIDMENT CHARACTERISTICS

Area	Sediment Types: Texture	Sediment Types: Petrology
Dune	2.56 MØ 2.85 SØ -1.04 SKØ Ref: 125	
Cont. Shelf		
Submarine Canyon-Fan		

Inventory Topic: Sediment Characteristics

Region: South Central

Sub Region: VI

Cell - Reach: Santa Maria

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type Petrology
Drainage Basin(s)		
River(s)		
Santa Maria River		(?) Lithology unk, thickness ±100' Heavy Minerals*: Ref: 56A Epidote 30, Augite 4, Hornblende 1, Chlorite -, Opaques 45
Cliffs		
Lagoon(s)		
Beach		
Pismo	2.3 to 2.4 MØ	Heavy Minerals*: 1-20% Ref: 56A Epidote 22, Augite 5, Hornblende 3, Chlorite 7, Opaques 40
Dune(s)		
Callendar Guadalupe Mussal Rock	100% "Sand" sized	
Cont. Shelf		
Submarine Canyon Fan		

*Percentages of selected species are given.

Inventory Topic: Sediment Characteristics

Region: South Central

Sub Region: VI

Cell - Reach: Santa Ynez

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type				
		Petrology				
Drainage Basin(s)						
River(s)						
Santa Ynez		Heavy Minerals*:			Ref: 56A	
		Epidote	Augite	Hornblende	Chlorite	Opaques
Jalama Ck.		18	9	1	-	48
		14	1	1	3	47
Cliffs						
Lagoon(s)						
Beach(s)						
Surf	0.3 M, 1.65 S					
Pt. Pedernales	0.29M, 1.25 S					
Pt. Arguello	0.23 to 0.25 M					
	1.19 to 1.45 S					
Pt. Conception	0.19 to 0.30 M					
	1.1 to 1.25 S	Ref: 140 A				
		Heavy Minerals:*		1-21%	Ref: 56A	
		Epidote	Augite	Hornblende	Chlorite	Opaques
Surf	1.3 to 1.9 MØ	33	5	5	2	35
Black Canyon	1.7 to 2.1 MØ	30	1	6	6	40
Cojo	1.8 to 2.3 MØ	30	3	1	4	40

*Percentages of selected heavy minerals are gi .

Inventory Topic: Sediment Characteristics

Region: South Central

Sub Region: VI

Cell - Reach: Santa Ynez (Continued)

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type		Petrology		
Dune		Heavy Minerals:*			Ref: 56A	
		Epidote	Auguite	Hornblende	Chlorite	Opaques
Shelf	2.6 to 2.7 MØ	34	3	3	1	30
Black Canyon	2.3 to 4.3 MØ	12	2	1	5	55
Govern' Pt.	2.1 to 2.6 MØ	20	2	2	2	55
Cojo	1.8 to 2.2 MØ	20	2	1	4	45
Cont. Shelf						
Surf	0.3 to 13M 1.1 to 1.35 S	Ref: 140A				
Pt. Pedernales	0.14 to 0.15 M 1.08 to 1.25 S	Ref: 140A				
Pt. Arguello	1.09 to 0.25 M 1.1 to 1.6 S	Ref: 140A				
Pt. Conception	0.13 to 0.26 M 1.1 to 1.5 S	Ref: 140A				
Submarine Canyon-Fan						

*Percentages of selected heavy minerals are given.

Inventory Topic: Sediment Characteristics

Region: South Central Region

Sub Region: VII

Cell - Reach: Santa Barbara

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type Petrology				
Drainage Basin(s)						
River(s)		Heavy Minerals:*			Ref: 56A	
		Epidote	Augite	Hornblende	Chlorite	Opaques
Ganiota Creek		27	1	2	6	38
Ventura River		20	5	8	11	34
Santa Clara	1.6 MØ	17	8	16	7	34
Callegues Creek		29	12	16	10	12
Malibu Creek		17	21	4	3	31
Cliffs						
Lagoon(s)						
Beaches						
Ventura County Beaches	.2 to .6 M	Heavy Minerals:*			Ref: 56A	
		Epidote	Augite	Hornblende	Chlorite	Opaques
El Capitan	1.7 to 2.1 MØ	22	2	2	3	35
Carpenteria	2.0 to 2.4 MØ	30	3	2	5	12
Summerland	2.1 MØ	17	2	2	6	30
San Buenaventura	1.4 to 2.0 MØ	30	4	2	4	35
McGrath	0.9 to 1.9 MØ	13	8	6	8	40
Point Mugu	0.8 to 2.0 MØ	7	8	7	7	56A

* Percentages of selected heavy minerals are given.

Area	Sediment Type: Texture	Sediment Type: Petrology
Beaches (Cont'd.)		
Coal Oil Point	1.9 to 2.8 MØ	Ref: 52
Government Point	1.8 to 2.6 MØ	Ref: 52
Gaviota (gravel-mid-beach)	65.8 M	Ref: 52
Gaviota (gravel-base of cliff)	23.6 M: 1.32 S	Ref: 52
Captain Beach	60.0 M; 1.26 S	Ref: 52
Ricon Beach	23.8 M; 1.37 S	Ref: 52
Ventura	233.0 M; 1.19 S	Ref: 52
Sycamore Point	375.0 M; 1.24 S	Ref: 52
Dune		
Cont. Shelf		
Scate Offshore	0.1 to 0.2 M -1.0 to 2.0 S	Quartz-Potassium feldspar--Palgioclase feldspar Epidote Ref: 39
Point Conception	3.0 MØ, 1.1 SØ	
Santa Barbara	4.5 MØ, 1.2 SØ	Ref: 160
Submarine Canyon-Fan		
Mugu	0.103 to 0.028 M	
Hueneme	0.3 to 0.025 M	
Hueneme	2.7 to 3.8 MØ 0.3 to 0.6 SØ	
Mugu	3.8 to 4.2 MØ 0.6 to 0.8 SØ	Ref: 160

Inventory Topic: Sediment Characteristics

Region: South Central

Sub Region: VIII

Cell - Reach: Santa Monica

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type Petrology				
Drainage Basin(s)						
Santa Monica Mts (sandstones, Lower Member, Modelo Formation)	0.05 to 2.0 M	Feldspar-Quartz-Ilmenite-Titanite-Garnet-Zircon-Hornblende-Tourmaline. Ref: 20				
River(s)		Heavy Minerals:* Ref: 56A				
		Epidote	Augite	Hornblende	Chlorite	Opaque
Calleguas Ck		29	12	16	10	12
Malibu Ck		17	20	4	3	31
Cliffs						
Lagoon(s)						
Beach						
Palos Verdes Peninsula (Pocket beaches)	Unk	M. Qtz., P. Qtz., Feldspar Magnetite, Hematite, Epidote, Tourmaline Ref: 111				
Gravel Sized Sediment						
Coral Beach	192.0 M, 1.30 S					
Will Rogers Beach	40.0 M, 1.28 S					
Redondo Beach	44.0 M, 1.27 S					
Malaga Cove	63.0 M, 1.27 S					
Vicente Cove	37.5 M, 1.16 S					
Whites Cove	40.0-134.0 M, 1.28 S Ref: 30					

* Percentages of selected heavy minerals are given.

Area	Texture	Sediment Type Petrology				
Beach		Heavy Minerals:* Ref: 56A				
		Epidote	Augite	Hornblende	Chlorite	Opaques
Sand Sized Sediment						
Leo Carrillo	0.99 to 1.5 MØ	7	9	4	4	50
Malibu	1.42 MØ	17	19	8	5	25
Hermosa	1.42 MØ	4	10	3	2	62
Lanada Bay	1.94 MØ	8	14	2	9	29
Cabrillo Beach	1.80 MØ	10	12	34	10	13
Bolsa Chica	0.65 MØ	6	6	31	23	10
Leo Carillo	0.5 to 1.5 MØ Ref: 41					
Malaga Cove	0.1 to 0.4 M	Quartz: 12% Plagioclose Feldspar: 5% Zircon: 10% Ref: 48				
Dockweiler Beach	1.24 to 2.11 MØ	Magnetite 37%, Ilmenite-Garnet: 40% Epidote-Pyroxenes-Hornblende: 17% Sphene: 5%, Zircon: 2% Ref: 167				
Dume						
Cont. Shelf	3.75 MØ, 0.75 SØ	Ref: 160				
Submarine Canyon-Fan						
Dume Canyon	0.069 to 0.38 M, 1.3 to 2.0 S, 0.65 to 1.1 SK	Ref: 21				
Dume Canyon Wall (Rocks from dredge haul)		"Sandstone" "Dacite" "Limestone" Ref: 34				
Dume	3.1 to 4.0 MØ 0.5 to 0.6 SØ					
Santa Monica	3.6 to 3.7 MØ 0.8 to 2.4 SØ					
Redondo	3.7 to 4.0 MØ 0.4 to 0.8 SØ	Ref: 160				

* Percentages of selected heavy minerals are given.

Inventory Topic: Sediment Characteristics

Region: South Coast

Sub Region: IX

Cell - Reach: San Pedro

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type Petrology				
Drainage Basin(s)						
Lake Elsinore	Coarse/Fine sand along shore of lake. Clay/silt on the lake bottom.	see note 16. Ref: 82				
River(s)						
Los Angeles		Hornblende, Hematite-Ilmenite, Epidote. Ref: 4A				
		Heavy Minerals* Ref: 56A				
		Epidote	Augite	Hornblende	Chlorite	Opaques
Los Angeles		9	6	23	12	33
Cliffs						
Laguna Beach	"Coarse Sands-Cobble" sized clasts	Clast petrology sasurite gabbro-serpentinite - Ref: 133				
Lagoon(s)						

*Percentages of selected heavy minerals are given.

Area	Sediment Type: Texture	Petrology
Beach		
Alliso Beach	"Coarse Sand"	
Crescent Beach	"Medium Sand" Ref: 809	
Corona Beach	1.3 to 2.5 MØ	Quartz-Plagioclase Feldspar Orthoclase-Heavy Minerals Ref: 1A
Newport Beach	0.4 M (after a storm) 0.2 M (before a storm) Ref: 36	
Cont. Shelf		
San Pedro Shelf	Fine grained Six types of sediment were found on the shelf. See note 19. Ref: 42A	Quartz, Hornblende garnets
San Pedro Shelf	Medium to Fine grained sands See note 20. 3.7 MØ, 0.75 SØ Ref: 160	Quartz, Feldspar, Hornblende, and Biotite. Ref: 89
Submarine Canyon-Fan		
San Pedro (outcrop in canyon)	Mudstone (with diatoms, Radiolaria)	
San Gabriel	3.7 to 4.0 MØ 0.3 to 0.7 SØ	
Newport	4.5 to 5.0 MØ 0.7 to 1.7 SØ Ref: 160	
Redondo (outcrop in canyon)	Metarhyolite Limestone, "granite", mudstone. Ref: 1525	

Inventory Topic: Sediment Characteristics

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type Petrology
Drainage Basin(s)		
River(s)		
Santa Margarita	Sand-Silt Sandy cobbles inland Ref: 127	
Las Pulgas Creek	0.52 to 1.5 MØ	Plagioclase, Orthoclase, Quartz, Biotite. Ref: 143A
Santa Margarita River	-0.64 to 3.1 MØ	Orthoclase, Plagioclase, Quartz, Biotite, Hornblende. Ref: 143A
San Luis Rey River	0.11 to 3.37 MØ	Plagioclase, Quartz, Orthoclase, Hornblende, Biotite. Ref: 143A
Cliffs	Del Mar Formation	
Solona Beach	2.2 to 2.4 MØ Torny Sandstone 1.4 to 2.3 MØ	Ref: 9
Dana Point	650 M, 1.22 S (Miocene breccia) Ref: 30	
La Jolla	Unk	Quartz, Plagioclase, Orthoclase, rock fragments. Ref: 35
	1.5 to 2.5 MØ 0.8 to 1.0 SØ	Orthoclase, Plagioclase Microcline, Biotite, Muscovite, silicic volcanic and Metamorphic rock fragments. Ref: 9.
Oceanside	1.3 to 1.8 MØ	Plagioclase, Quartz, Hornblende, Orthoclase Biotite. Ref: 143A

Sediment Type

Area	Texture	Petrology
Lagoon(s)		
Buena Vista	1.8 to 2.1 MØ	Hornblende, Plagioclase Quartz, Orthoclase
Agua Hedionda	2.2 to 2.5 MØ	Hornblende, Plagioclase Quartz, Orthoclase Ref: 143A
Beach		
All beaches	Unk	Quartz, and Feldspar Ref: 42
Dana Point	22 M, 1.18 S	
Encinitas	52 M, 1.29 S	
La Jolla	40 M, 1.47 S Ref: 30	
Oceanside	3.6 to 1.7 MØ	(See note 21) Quartz-Plagioclase-Orthoclase-Heavy Minerals Ref: 143B
Solana to La Jolla	2.0 to 2.3 MØ	Quartz-Plagioclase-Orthoclase-Heavy Minerals Ref: 143C
San Onofre to Oceanside	1.0 to 1.5 MØ	Quartz-Plagioclase-Orthoclase-Heavy Minerals Ref: 143C
Dana Pt. to San Onofre	-2.6 to 1.8 MØ	(See note 21) Quartz-Plagioclase-Orthoclase-Heavy Minerals Ref: 143C
Dune		
Cont. Shelf	4.0 MØ, 0.75 SØ Ref: 160	
Submarine Canyon-Fan		
La Jolla (Canyon Wall)	Shale, Granite, Metavolcanic, Sandstone Ref: 34	

Area	Texture	Sediment Type	Petrology
Submarine Canyon-Fan (Con't.)			
Carlsbad	4.7 to 4.9 MØ 0.8 to 1.8 SØ Ref: 160		
La Jolla	3.0 to 3.5 MØ 0.8 to 1.2 SØ Ref: 160		

Inventory Topic: Sediment Characteristics

Region: San Diego

Sub Region: X

Cell - Reach: Mission Bay

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type	Petrology
Drainage Basin(s)			
San Diego			
River(s) San Diego			
Cliffs			
Lagoon(s)			
Beach			
Mission Beach	1.7 to 2.6 MO	Quartz, Plagioclase Orthoclase, Heavy Minerals. Ref: 143C	
Dune			
Cont. Shelf	"Sand" Ref: 156		
Submarine Canyon-Fan			

Inventory Topic: Sediment Characteristics

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand

SEDIMENT CHARACTERISTICS

Area	Texture	Sediment Type	Petrology
Drainage Basin(s)			
River(s)			
Cliffs			
Lagoon(s)			
Beach	2.5 to 1.5 MØ	Plagioclase, Quartz, Orthoclase, Heavy Minerals (Hornblende, Hypersthene, Enstatite). Ref: 143D	
Dune			
Cont. Shelf Tijuana Delta (shoreline to 4.5 miles offshore)	Gravel mud boulders	Volcanic, Igneous and Metamorphic Rocks. Ref: 31	
Corando offshore	Scattered gravel	Volcanic, Igneous, Metamorphic, and Sedimentary Clasts. Ref: 31	
Entire shelf except the areas noted above	0.0 to 2.MØ	80-90% Quartz, Plagioclase, Orthoclase. 10-20% Heavy Minerals (Hornblende, Actinolite, Epidote) Ref: 31	

Area	Sediment Texture	Petrology
Submarine Canyon-Fan		
Tijuana	1.8 to 2.2 MØ 3.2 to 3.9 SØ Ref: 160	

Data Summary - Inventory Comments

Inventory Subject: Geologic Processes

1. With continued cliff erosion along any given section of beach, small changes in rock type of the cliff can contribute to very different potential rates of erosion. Ref: 4.

2. The calculated rate of erosion of the beach associated with aeolian(wind) transport was based on air photo interpretation, and field measurements. Assumptions were also made by the author on the mean dune height, the area occupied by vegetation and the slip face of the dune. Ref: 30.

3. Landsat image interpretation indicates the following Ref: 24

   1 - May - June images most clearly show areas of calm water, rough water, swells, or possible internal waves*.

   2 - Fine grained sediments are mostly deposited in nearshore areas.

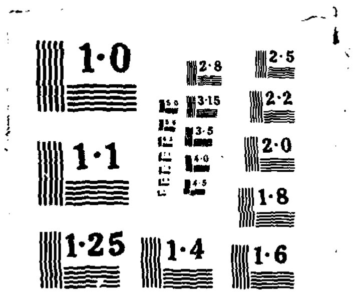
4. Depositional sequences which included interbedded parallel and crossbedded layers of different types of sandy material on the beach are interpreted as having been deposited during a single period of time. Ref: 51.

5. In the Goleta Point area it was shown, Ref: 52, that offshore rocks may channelize the flow of sediment in a shore parallel direction.

6. Landsat can be used as an aid to select optimum locations to conduct surface current sediment transport studies along the shoreline. Ref: 107.

* See Glossary

AD-A167 734 GEOTECHNICAL DATA INVENTORY SOUTHERN CALIFORNIA COASTAL 2/
ZONE CAPE SAN MAR..(U) ARMY ENGINEER DISTRICT LOS
ANGELES CA COASTAL RESOURCES BRANC.. DEC 85
UNCLASSIFIED CCSTWS-85-5 F/G 8/6 NL


1·0
2·8
2·5
5·0
3·15
2·2
3·5
2·0
1·1
4·0
4·5
1·8
1·25
1·4
1·6

Data Summary - Inventory Comments

Inventory Subject: Geologic Processes

7. Complex currents in the offshore Ventura area transport suspended sediment from the Ventura or Santa Clara Rivers across the shelf. Ref: 107.

8. Sediment tracer tests seaward of the surf zone indicate that sand sized material can potentially move in any direction. Ref: 32.

9. On the San Pedro shelf, rip currents further disperse sediment once the sediment is transported seaward of the surf zone. Ref: 50.

10. The eastern half of the San Pedro shelf has experienced relatively little sediment accumulation; the western half of the shelf has experienced relatively high rates of sediment deposition. Ref: 59.

11. Texture data on sediment samples collected in the area of offshore Laguna Beach indicate that sand sized sediment is not being bypassed around the rocky headland that separates the San Pedro Cell from the Oceanside Cell. Ref: 80.

12. The San Pedro submarine canyon is inactive. Ref: 92.

13. Sediments collected in the water column in the surf zone indicate that "a small increase in maximum orbital velocity. . . results in a great amount of sediment transport." Ref: 37.

14. Rates of sand transport which were calculated from sediment tracer studies for Goleta Pt., Trancas, Santa Monica, Huntington, and La Jolla Beaches are expressed in cu. yds./day per linear foot of beach. Ref: 52.

Data Summary - Inventory Comments

Inventory Subject: Geologic Processes

15. One of this century's most severe storms, the storms of December 1940, is described in Ref: 70.

16. Cliff erosion rates which are based on studies conducted over the last 25 to 30 years may be too low. Ref: 72, 73.

17. The deep water channels in the La Jolla Submarine fan, which contain coarse sand and pebbles, have been described as active channels. Ref: 94.

18. Based on live-dead ratios, and the presence-absence and relative abundance of selected species of macroinvertebrates, mixing of depositional environments with the Tijuana and Mugu lagoons does not occurr to any great extent. Ref: 104.

20. Foraminifera have been used to document the recent depositional history of Los Penasquitos Lagoon. Ref: 121.

21. Oscillating currents (with a maximum average velocity of 30 cm./sec.) which move up and down the axis of submarine canyons have been identified in the La Jolla, Newport, and Hueneme submarine canyons.

22. Sediment tracer studies offshore of Silver Strand beach indicate that sand will migrate in two different directions over a very short length of time.

23. Sediment tracer studies conducted on Zuniga Shoal indicate that the tracer sediment was moving in a direction opposite to the direction of wave travel. Ref: 52.

Data Summary - Inventory Comments

Inventory Subject: Geologic Processes

24. The erosion of the Cretaceous rocks at Sunset Cliffs is somewhat controlled by joint planes in the rock. Ref: 63.

25. Ground water also contributes to sea-cliff failure. Ref: 63.

Inventory Topic: Erosion - Deposition

Region: South Central

Sub Region:

Cell - Reach: Morro Bay Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs			
Fluvial			
Littoral			

DEPOSITION			
Fluvial			
Lagoon			
Delta			
Shelf	Surface currents move fine grained seds from N to S. Ref: 107		
Submarine Canyon(s)			
Aeolian (from beach)			
Littoral			

Inventory Topic: Erosion - Deposition

Region: South Central

Sub Region: VII

Cell - Reach: Santa Maria River Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs Vicinity of Pt. Sal	Quaternary Rocks (Orocult Sandstone)	40,000 cu. yds./yr. Ref: 8	
Shell Beach	Tertiary rocks (bedded pyroclastics)	0.1-1.1 ft./yr. Ref: 4	
Fluvial			
Littoral			
DEPOSITION			
Fluvial			
Lagoon			
Delta			
Shelf	Surface currents move fine grained seds from N to S Ref: 107		
Submarine Canyon(s)			
Aeolian (from beach)	back beach dunes	5 meters/yr. 150,000 cu. yds./y-. Ref: 8	"Prevailing NW winds" Ref: 8
Littoral			

Inventory Topic: Erosion - Deposition

Region: South Central

Sub Region: VI

Cell - Reach: Santa Ynez River Cell

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs	Cliffs near Pt. Arguello	25,000 cu. yds./yr. Ref: 8	
Fluvial			
Littoral			
DEPOSITION			
Fluvial			
Lagoon			
Delta			
Shelf	Surface currents move fine grained seds from N to S Ref: 107		
Submarine Canyon(s)			
Aeolian (from beach)	back beach dune	80,000 cu. yd./yr. Ref: 8	"Prevailing NW Winds" Ref: 8
Littoral			

Inventory Topic: Erosion - Deposition

Region: South Central

Sub Region: VII

Cell - Reach: Santa Barbara Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs			
Fluvial			
Littoral	Goleta Point Beach (sand tracer study)	91 (July '61) to 2,709 (April '61) cu. yds./day Ref: 52	
DEPOSITION			
Fluvial			
Lagoon			
Shelf	Santa Barbara-Oxnard Study 1-Sands from Santa Barbara migrate to the southwest 2-Sand from Oxnard, migrate to the North west. 3-Central shelf is an area of nondeposition, with little sand being deposited. Ref: 115		
	Santa Barbara (basin) 0.4 cm/yr Ref: 67 0.4 cm/yr Ref: 68		
	Nearshore currents N to S with gyre* to SW (Analapa current). Ref: 24.	Ventura-Pt. Mugu Depositional sequences up to 50 cm (45 cm average) thick Ref: 51	

* See glossary.

EROSION	Environment	Volume/Rate	Associated Weather
Delta		Santa Clara delta 13,200,000 cu. yds. (Jan-Feb 1969)	Jan-Feb 1969 storm Ref: 143E
Submarine Canyon			
Aeolian			
Littoral	Shoreface (0' to-30' MLLW) Ventura-Pt. Mugu Beach	Interbedded sands and crossbedded sands 1mm to 2 cm thick Pt. Mugu Ref: 51	
	Pt. Mugu, washover fans	40 by 150 feet, 6 inches thick. Ref: 120	

Inventory Topic: Erosion - Deposition

Region: South Coast

Sub Region: VIII

Cell - Reach: Santa Monica Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs			
Fluvial			
Littoral	Santa Monica Beach (sand tracer study)	75 (July '61) to 1376 (Feb '61) cu. yds./day Ref: 52	
	Trancas Beach Santa Monica Beach	Sand moves obliquely offshore parallel to wave crests. Ref: 52	
	Trancas Beach (Sand tracer study)	117 (July '61) to 1671 (Nov '61) cu. yds/day. Ref: 52	
DEPOSITION			
Fluvial			
Lagoon			
Shelf	Santa Monica Basin	1,200,000 cu. yds./yr. (Pb-210) Ref: 81	
	Santa Monica Basin	15,300 tons/yr. Ref: 92	
	Vicinity of Pt. Dune	Surface currents move fine grained seds S-West. Ref: 24	

EROSION	Environment	Volume/Rate	Associated Weather
	Santa Monica-Palos Verdes	Surface currents move (oceanographic winter) fine grained seds around Palos Verdes Peninsula Ref: 24, Ref: 107.	
Delta			
Submarine Canyon	Redondo Submarine Canyon	Most coarse grained sediments are deposited, by well defined distributary channels, on the lower-middle fan surfaces Ref: 92.	
Aeolian	El Segundo Sand Hills		
Littoral			

Inventory Topic: Erosion - Deposition

Region: South Coast

Sub Region: IX

Cell - Reach: San Pedro Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs	Quaternary Rocks Tertiary Rocks Igneous Rocks	9"/yr 2"/yr .2"/yr Ref: 108	
Fluvial	San Gabriel Mts	.1"/yr Ref: 130	
Littoral	Huntington Beach (sand tracer study)	75 (Dec '61) to 2875 (Sept '61) cu. yds./day Rip currents pump shore-parallel moving seds directly offshore. Ref: 52	
DEPOSITION			
Fluvial			
Lagoon			
Shelf	San Pedro Shelf	Surface currents move fine grained seds up-coast year round Ref: 107	
	San Pedro Shelf	Sedimentation rate 0.01 to 0.06 cm/yr Ref: 58	
	San Pedro Shelf	Much if not all suspended seds are transported to and deposited on the shelf. Ref: 24	

DEPOSITION	Environment	Volume/Rate	Associated Weather
Delta			
Submarine Canyon	San Pedro	Inactive Ref: 92	
Aeolian			

Inventory Topic: Erosion - Deposition

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs	Cliffs vicinity of Camp Pendleton (one canyon)	50,000 cu. yds/day	Winter storm, 20 Feb 1980, Ref: 71
	Estimated total sediment production	300,000 cu. yds/yr. Ref: 71	
	Erosion, San Onofre Area	15'/yr (canyon erosion)	Storms Jan-Mar 1978 Ref: 5
	Marine Erosion Subaerial Erosion	40% of cell 60% of cell Ref: 32	
	La Jolla Cliffs (Quaternary Rocks)	1'/yr. Ref: 69	
	Del Mar Cliffs	30'/day	1941 storm Ref: 70
Fluvial			
Littoral	La Jolla Beach (Sand tracer Studies)	74 (Jan '62) to 934 (May '61) cu. yds/day Ref: 52	
DEPOSITION			
Fluvial			
Lagoon	Los Penasquieto	9.5 cm/100 yrs. Ref: 91	
	Agua Hedondia	138,000 to 168,000 cu. yds/yr. Ref: 113	
Shelf	Surface currents which transport fine grained sediments	Transport is to the south, except localized northward transport (vicinity of Oceanside) during July-Nov. Ref: 107	

DEPOSITION	Environment	Volume/Rate	Associated Weather
Delta			
Submarine Canyon	La Jolla	8 cm/1000 yrs to 12.6 cm/1000 yrs. Ref: 126	
Aeolian			

Inventory Topic: Erosion - Deposition

Region: San Diego

Sub Region: X

Cell - Reach: Mission Bay Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs	Cretaceous Rocks	0.03 to 30 cm/yr Ref: 32	
	Sunset Cliffs	1 meter/yr Ref: 63	
Fluvial			
DEPOSITION			
Fluvial			
Lagoon	Mission Bay	13 cm/100 yrs Ref: 91	
Shelf	Near shore surface carrying fine grained sediments	Move north to south in the Winter Season, and from south to north in the Summer Season. Ref: 107	
Delta			
Submarine Canyon			
Aeolian			

Inventory Topic: Erosion - Deposition

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand Cell - Reach

EROSION	Environment	Volume/Rate	Associated Weather
Cliffs			
Fluvial			
Littoral			
DEPOSITION			
Fluvial			
Lagoon			
Shelf	Near shore currents carrying fine grained sediments	Move from south to north. Ref: 107.	
Delta			
Submarine Canyon			
Aeolian			

Data Summary - Inventory Comments
Inventory Subject: Landmass Changes

Subsidence

1. The only area where significant subsidence has occurred is the area of Terminal Island.

Emergence

1. Studies of regional scale profiles of the coastal landforms of California indicate that the coastal region is subdivided into reaches each of which has undergone differing rates of emergence. Ref: 103

2. The coastal reaches which have undergone relatively large scale emergence are associated with know active faults. Ref: 103

3. Since there is no indication of the absolute age for coastal emergence for the entire region published data on the relative age and/or amount of topographic change is given. For example, if the coastline is terraced then the number of terraces is given along with the elevation of the highest and the lowest terrace. Ref: 103.

4. The area within the Morro Bay Cell - Reach has the best developed terraces. Those terraces cover relatively large coastal areas in the Cape San Martin to Cayocos area, and a published regional profile of the area shows at least five terraces that can be separately traced throught the entire area. Ref: 103

Data Summary - Inventory Comments

Inventory Subject: Landmass Changes

5. In Subregion 7, the most active area of terrace formation has occurred at Rincon Mountain. (Carpinteria to Ventura). Ref: 103
   If the estimated age for the youngest terrace at Rincon Mountain is taken to be 10,000 years old and if the rate of emergence continues, then that section of the shoreline could be uplifted approximately 4 to 11 feet in the next 50 years.

6. Long ridges of sandy material which are aligned parallel to the shoreline in the area have been found along the top of some of the terraces. Ref: 103.

Inventory Subject: Landmass Changes

Region: South Central

Sub Region: VI

Cell - Reach: Morro Bay Cell - Reach

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	San Simeon, and Cambria Quads	5 terraces Highest 600' elev. Lowest 20'-30 elev. Ref: 103	
TECTONIC ACTIVITY	Offshore Area	Palo Colorado- San Gregorio Fault Ref: 29A	

Inventory Subject: Landmass Changes

Region: South Central

Sub Region: VI

Cell - Reach: Santa Maria River Cell - Reach

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	Arroyo Grande Quad	(?) 5 terraces Highest 400' elev. Lowest 30'-50' elev. Ref: 103	
TECTONIC ACTIVITY	Offshore Area	Palo Colorado- San Gregorio Fault, Purisma, and Pleasanton Faults Ref: 29A	

Inventory Subject: Landmass Changes

Region: South Central

Sub Region: VI

Cell - Reach: Santa Ynez River Cell - Reach

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	Casmalia, Surf, and Tranquillion Mt. Quads	3(?) Terraces Highest: 700' elev. Lowest: 30'-50' elev. Ref: 103	
TECTONIC ACTIVITY		Mapped faults are shown as inactive Ref: 168	

Inventory Subject: Landmass Changes

Region: South Central

Sub Region: VII

Cell - Reach: Santa Barbara Cell - Region

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	Point Arguello to Carpenteria	5 terraces Highest: 600' elev. Lowest: 30' to 100' elev. Ref: 103	
	Carpenteria to Pitas Point	6 terraces Highest: 2100' elev. Lowest: 250' to 800' elev. Ref: 103 0.5' to 1.5'/50 yrs Ref: 76	
	Pitas Point to Ventura	2 terraces Highest: 900' elev. Lowest: 100' to 250' elev. Ref: 103	
		7 terraces Highest: 1050' elev. Lowest: 50'-70 elev. Ref: 103.	
TECTONIC ACTIVITY	A small segment of the Ventura Avenue fault (in the town of Ventura) has been mapped as active, other mapped faults are shown as inactive. Ref: 168		

Area	Rate	Cause
The Red Mountain, Oakridge and/or other associated faults (located at Rincon Point) are mapped as active, other faults are mapped as inactive. Ref: 168, 29A.		
Point Arguello to Carpenteria. Mapped faults are shown as inactive. Ref: 168.		
Point Mugu to Solormar mapped faults are shown is inactive Ref: 168		

Inventory Subject: Landmass Changes

Region: South Coast Region

Sub Region: VIII

Cell - Reach: Santa Monica Cell - Reach

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	Point Dume to Santa Monica	9 terraces Highest: 900' elev. Lowest: 100' elev. Ref: 103 0.4"/50 yrs Ref: 76	
	Palos Verdes	13 terraces Highest: 1200' elev. Lowest: 100' elev. Ref: 103.	
TECTONIC ACTIVITY	Active-Potentially Active Faults Inglewood, Charnoc Faults. Ref: 29A		

Inventory Subject: Landmass Changes

Region: South Coast

Sub Region: IX

Cell - Reach: San Pedro Cell - Reach

	Area	Rate	Cause
SUBSIDENCE	Terminal Island	2'/year, 28 feet total	Oil and Gas Production Ref: 129
EMERGENCE	Newport Beach to San Clemente	(?) 6 Terraces Highest: 700' elev. Lowest: 50' elev. Ref: 103 2" to 12" /50 yrs. Ref: 76	
TECTONIC ACTIVITY	Newport	Newport Inglewood Fault. Ref: 29A	
	Dana Pt.	Shady Canyon Fault Ref: 29A	

Inventory Subject: Landmass Changes

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside Cell - Reach

	Area	Rate	Cause
SUBSIDENCE	La Jolla	-7 cm/100yrs Ref: 43	
EMERGENCE	San Clemente to Mission Beach	(?) 4 terraces Highest: 650' elev. Lowest: 30' elev. Ref: 103	
	Coastal Area	0.2" to 1.2"/50 yrs Ref: 76	
TECTONIC ACTIVITY	Dana Pt. offshore	Cristianitos Fault Newport Inglewood Fault Zone. Ref: 29A	

Inventory Subject: Landmass Changes

Region: San Diego

Sub Region: X

Cell - Reach: Mission Beach Cell - Reach

	Area	Rate	Cause
SUBSIDENCE			
EMERGENCE	Inland Mission Bay Area	5 Terraces Highest: 525' elev. Lowest: 20' elev. Ref: 103	
	Coastal Area	0.2" to 1.2"/50 yrs Ref: 76	
TECTONIC ACTIVITY	Mission Bay	Rose Canyon Fault Ref: 29A	

Inventory Subject: Landmass Changes

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand Cell - Reach

	Area	Rate	Cause
SUBSIDENCE	Balboa	3 cm/100 yrs Ref: 143	
EMERGENCE	Inland Silver Strand Beach Area	5 Terraces Highest: 525' elev. Lowest: 20' elev. Ref: 103	
	Coastal Area	0.2" to 1.2" /50 yrs Ref: 76	
TECTONIC ACTIVITY	San Diego Bay	Rose Canyon Fault Ref: 29A	

Data Summary - Inventory Comments

Inventory Subject: Sand and Gravel Mining

1. The inventory sheet for each cell consists of three sections, the quantities of sand and gravel production, the potential impact on the littoral sediment budget and the potential volume of sand gravel that could be mined offshore. The production figures in the first section are based on the latest available data. The data concerning the impact of sand and gravel production on the littoral sediment budget are based on the projected consumption of the produced aggregates onshore and the estimated sand and gravel resources located offshore.

2. The quantity listed represents sand and gravel production from the San Gabriel Fan Production District, which is located along the upper San Gabriel River. Ref: 88

3. The quantity listed represents sand and gravel production from the Tujunga Fan Production District, which is located 15 miles northwest of Los Angeles. Ref: 88.

4. The quantity listed represents sand and gravel production from the Santa Clara River Production District, located 30 miles northwest of Los Angeles, Ref: 88. Within the Santa Barbara Cell it is uncertain what percentage of the total sand gravel production the Santa Clara River represents because data from other rivers are presently not available.

5. The projected consumption of aggregate assumes that the per capita consumption for a five year period equals 27 tons/person, along with a projected population growth of 12 percent in western San Diego County from 1985 to 1990.

Data Summary - Inventory Comments

Inventory Subject: Sand and Gravel Mining

6. The projected population growth in the San Gabriel Valley is about 5 percent from 1985-1990.

7. The projected population growth in Orange Co. is about 10 percent from 1985 to 1990.

8. The production quantities are taken from responses to a voluntary questionnaire annually sent to all known mining operations and complied into state, county and U.S. Bureau of Mines reports. The accuracy of those responses cannot be verified.

10. All production figures have been converted from weight units to volume units, assuming 1.55 ton/yd^3.

11. The resources were calculated from exploration of sedimentary environments capable of yielding considerable sand and/or gravel material with little fine-grained sediments. The information was taken primarily from vibracore logs with seismic data as alternative or supplemental information. The search was limited to sites that are practical for commercial extraction.

Inventory Subject: Sand and Gravel Mining

Region: South Central

Sub Region: VII

Cell - Reach: Santa Barbara

Quantities

Quantity Extracted	Production Year	Production Area	
0.55 million $yards^3$	1975 Ref: 88	Santa Clara	See Comments 4 & 8

Impact on Littoral Sediment Budget

Projected Consumption	Production Period	Production Area

Offshore Resource	Area	Volume

Inventory Subject: Sand and Gravel Mining

Region: South Central

Sub Region: VIII

Cell - Reach: Santa Monica

Quantities

Quantity Extracted	Production Year	Production Area
Unknown		

Impact on Littoral Sediment Budget

Projected Consumption	Production Period	Production Area

Offshore Resource	Area	Volume
	Santa Monica	104-285 million cu. yds. See Comment 11. Ref: 99

Inventory Subject: Sand and Gravel Mining

Region: South Central

Sub Region: IX

Cell - Reach: San Pedro

Quantities

Quantity Extracted	Production Year		Production Area	
8.0 million $yards^3$	1975	Ref: 88	Upper San Gabriel R.	See comment 2
7.4 million $yards^3$	1977	Ref: 85	Orange County	
2.8 million $yards^3$	1975	Ref: 88	Upper Tujunga Wash	See comment 3 See comment 8

Impact on Littoral Sediment Budget

Projected Consumption	Production Period		Production Area	
51.0 million $yards^3$	1985-1990	Ref: 66-1	San Gabriel Valley	See comments 6 and 10
51.6 million $yards^3$	1985-1990	Ref: 85	Orange County	See comments 7 and 10

Offshore Resource	Area	Volume
456 million yd^3	San Pedro Bay Ref: 99	See comment 11

Inventory Subject: Sand and Gravel Mining

Region: San Diego

Sub Region: X

Cell - Reach: Oceanside

Quantities

Quantity Extracted	Production Year	Production Area
1.5 million yards^3	Annual Average 1947-1956 Ref: 143-D	Western San Diego Co. See comments 8 & 9

Impact on Littoral Sediment Budget

Projected Consumption	Production Period	Production Area
[illegible] million yards^3	1985-1990 Ref: 66-2	Western San Diego Co. See comments 5 & 10

[illegible]	Area	Volume
	Oceanside to La Jolla	109.9 million yd^3 Ref: 101 See comment 11

Inventory Subject: Sand and Gravel Mining

Region: San Diego

Sub Region: X

Cell - Reach: Mission Beach

Quantities

Quantity Extracted	Production Year	Production Area
1.5 million $yards^3$	Annual Average 1947-1956 Ref: 143-D	Western San Diego Co. See Comments 8 and 9

Impact on Littoral Sediment Budget

Projected Consumption	Production Period	Production Area
37.3 million $yards^3$	1985-1990 Ref: 66-2	Western San Diego Co. See Comments 5 and 10

Offshore Resource	Area	Volume
	Mission Beach	192.0 million yd^3 Ref: 101 See Comment 11

Inventory Subject: Sand and Gravel Mining

Region: San Diego

Sub Region: X

Cell - Reach: Silver Strand

Quantities

Quantity Extracted	Production Year	Production Area
1.5 million $yards^3$	Annual Average 1947-1956 Ref: 143-D	Western San Diego Co. See comments 8 and 9

Impact on Littoral Sediment Budget

Projected Consumption	Production Period	Production Area
37.3 million $yards^3$	1985-1990 Ref: 66-2	Western San Diego Co. See comments 5 & 10

Offshore Resources	Area	Volume
	Pt. Loma to Mexican Border Ref: 10 See comment 11	379.5 million yd^3

GLOSSARY

Flandrian - That section of geologic time that began during the last glacial period, (10,000 years ago) and existed until about 5,000 years ago.

Foraminifera - Single celled marine amoeba-like animal that builds a shell similar to that of snail. The shell ranges in size 0.1 to 0.3 mm.

Gyre - Circular motion of surface sea water.

Internal Waves - Waves that occur within a fluid whose density changes with depth, either abruptly at a sharp surface of discontinuity or gradually.

References

All of the references that were reviewed for this report were assigned a Geotechnical Branch internal reference number. These numbers are used through out the text of the report as well as on the plates.

Geotech. Ref: No. 1A

Anderhalt, R. W.

1981 Beach Foreshore Sedimentation by Organic and Inorganic Process
Ph.D. Thesis, Geology Department, University of California,
Los Angeles, California, 197 pp.

Geotech. Ref: No. 1

Anderson, G. E.

1926 Experiments on the Rate of Wear of Sand Grains
Journal of Geology, Vol. 34, pp. 144-158.

Geotech. Ref: No. 2

Anderson, J. R.,; Lins, H. F.

1978 Coastal Applications of U.S.G.S. Land Use Data
Coastal Zone '78, ASCE, N.Y., Vol. 11, pp. 943-964.

Geotech. Ref: No. 3

Artim, E. R.; Elder, D. L.

1979 Late Quarternary Deformation Along the Nacion Fault System
San Diego, California.
Geol. Sec. of Amer., Annual Meeting, San Diego, California,
p. 381.

Geotech. Ref: No. 4

Asouith, D. O.

1983 Rates of Coastal Bluff Retreat Pismo Beach, California
Coastal Zone '83, ASCE, N.Y., pp. 1195-1207.

Geotech. Ref: No. 4A

Azmon, E.

1960 Heavy Minerals in Sediments of Southern California
Ph.D. Thesis, University of Southern California, Los Angeles, California 139 pp.

Geotech. Ref: No. 5

Berggren, R. G.

1977 Geology of the Proposed Camp Pendleton LNG Site, San Diego, County, California
Geologic Guide of the San Onofre Nuclear Generating Station and Adjacent Regions of So. California, D. L. Fife, Ed., Amer. Assoc. of Petr. Geol., Bakersfield, California, pp. A49-A62.

Geotech. Ref: No. 6

Bergen, F. W.

1971 Road Log, Maps and Stratigraphic Sections, Newport Lagoon to San Clemente, California
In: Geologic Guide Book, Coastal Exposures of Miocene and Early Pliocene Rocks, Pacific Section, Soc. of Econ. Min. and Paleon., Bakersfield, California, pp. 1-21.

Geotech. Ref: No. 7

Berggren, R. G.; Streiff, D.

1979 Recency of Faulting on the Mount Soledad Branch of the Rose Canyon Fault Zone in Northwestern Metropolitan San Diego County, California
Annual Meeting, Geol. Soc. of Amer., San Diego, California p. 387.

Geotech. Ref: No. 8

Bown, A. J., Inman, D. L.

1966 Budget of Littoral Sands in the Vicinity of Point Arguello, California
Technical Memorandum No., 19, Coastal Engineering Research Center, U.S. Army Corps of Engineers, Ft. Belvoir, Va., December 1966.

Geotech. Ref: No. 9

Boyer, J. E.; Warme, J. E.

1975 Sedimentary Facies and Trace Fossils in the Eocene Del Mar Formation and Torrey Sandstone, California
Paleogene Symp. and Selected Tech. Papers, Conf. of Future Energy Horizons of the Pac. Coast, D. W. Weaver, et. al., Eds., Long Beach, Calif., AAPG-SEPM-SEG, Tulsa, Okla., pp. 65-98.

Geotech. Ref: No. 10

Brooks, S. T.; Conrey, B. L.; Dixon, K. A.

1965 A Deeply-Buried Human Skull and Recent Stratigraphy at the Present Mouth of the San Gabriel River, Seal Beach, California
Southern California Acad., Sci., Bulletin, Vol. 64, Part 4. pp. 229-241.

Geotech. Ref: No. 11

Brown, A. J.

1983 Space and Time Relationship on Ventura County Beaches, California
Thesis (PH.D.) Geo. Rept., University of California, Los Angeles, California, pps 1-163.

Geotech. Ref: No. 12

Brownlie, W. R.; Brown, W. M.

1978 Effects of Dams on Beaches, Sand Supply

Coastal Zone '78 Amer. Soc., of Civil Engineers, New York, N.Y.

pps 2273-2287.

Geotech. Ref: No. 13

Buffington, E. C.

1951 Gullied Submarine Slopes Off Southern California

Geologic Society of America, Bulletin, Vol. 62, p. 1497.

Geotech. Ref: No. 13A

Bureau of Land Management

Surface Management Index (pamphlet)

1982 BLM Sacramento, Calif. 2 pages, U.S. Department.

Geotech. Ref: No. 14

Campbell, R. H.

1979 Soil Slips, Debris Flows, and Rainstorms in the Santa Monica Mountains and Vicinity, Southern California, Los Angeles, Calif. Field Guide to Selected Engineering Geologic Features, Santa Monica Mountains, J. R. Keaton, Ed., Assoc. of Engr. Geol., So. Calif., Section, Los Angeles, California, pp. 26-38.

Geotech. Ref: No. 15

Castle, R. O.

1960 Geologic Map of the Baldwin Hills Area, California

Open File Map 69-72, U.S. Dept, of Interior, Geological Survey, Menlo Park, California.

Geotech. Ref: No. 16

Castle, R. O.

1960 Geologic Map of Beverly Hills and Venice Quadrangles - Surficial Geology
Open File Map 60-26, U.S. Dept. of Interior, Geology Survey, Reston, Virginia.

Geotech. Ref: No. 17

Chamberlain, T. K.

1964 Map Transport of Sediment in the Heads of Scripps Submarine Canyon, California
Papers Marine Geology - Shepard Commemorative Volumes, Machmillan, New York, pps. 42-64.

Geotech. Ref: No. 18

Cleveland, G. B.

1976 Geologic Map of the Northeast Part of the Palos Verdes Hills, Los Angeles County, California.
Map Sheet 27, California Division of Mines and Geology, Sacramento, California

Geotech. Ref: No. 19

Caparrublas, J. W.

1979 Debris Flows and Landslides, City of Los Angeles
Field Guide to Selected Engineering Geologic Features, Santa Monica Mountains, J. R. Keaton, Ed., Assoc. of Engr. Geol., Southern California, Section, Los Angeles, Calif., pp. 19-25.

Geotech. Ref: No. 20

Cogen, W. M.

1936 Heavy Mineral Zones in the Modelo Formation of the Santa Monica Mountains, California
Journal of Sed. Pet., Vol. 6, No. 1, pp 3-15.

Geotech. Ref: No. 21

Cohee, G. Y.

1938 Sediments of the Submarine Canyons of the California Coast
Journal of Sed. Petrology, V. B., p. 19-32.

Geotech. Ref: No. 22

Cooper, W. S.

1967 Coastal Dunes of California
Memoir 104, Geol., Soc., of Amer., 125 pp.

Geotech. Ref: No. 23

Crist, O. H.

1980 A Scanning Electron Microscopy Study of Pleistocene and Holocene Sand Samples From Santa Monica Bay, Southern California
M. S. Thesis, University of Southern California, Los Angeles, California, 81 pp.

Geotech. Ref: No. 24

Davis, C. C.

1980 Landsat Image Analysis of Circulation and Suspended Sediment
M. S. Thesis, University of Southern California, Los Angeles, California, 216 p.

Geotech. Ref: No. 25

Crowell, J. C.

1952 Submarine Canyons Bordering Central and Southern California
Journal of Geology, Vol. 60, pp. 58-83.

Geotech. Ref: No. 26

Dibblee, T. W.

1950 Geology of Southwestern Santa Barbara County, California
Bulletin 150, California Division of Mines, Sacramento, Calif., 95 pp.

Geotech. Ref: No. 27

Dibblee, T. W.

1966 Geology of the Central Santa Ynez Mountains, Santa Barbara County, California
Bulletin 186, California Division of Mines and Geology, San Francisco, California, 99 pp.

Geotech. Ref: No. 28

Dietz, R. S.

1947 Aerial Photographs in the Geological Study of the Shore Features and Processes
Photogrammetric Engineering, Vol. 13., pp. 537-545.

Geotech. Ref: No. 29

Dobbs, P. H.

1958 Effects of Wave Action on the Shape of Beach Gravel
The Compass, Vol. 35, No. 4, pp. 269-275.

Geotech. Ref: No. 29A

Eguchi, R. T.; Campbell, K. W.; Higgins

1979 A Survey of Expert Opinion on Active and Potentially Active Faults in California, Nevada, Arizona, and Northern Baja California.
Open File Report, No. 79-1328-2, U.S. Dept. of Interior, Geological Survey, Menlo Park, California, 70 pp.

Geotech. Ref: No. 30

Emery, K. O.

1955 Size Distribution of Gravels
Journal of Geology, Vol. 63, pp. 39-49.

Geotech. Ref: No. 31

Emery, K. O.; Butcher, W. S.; Gould, H. R.; Shepard, F. P.

1952 Submarine Geology off San Diego, California
Journal of Geology, Vol. 60, No. 6, pp. 611-548.

Geotech. Ref: No. 32

Emery, K. O.; Kuhn, G. G.

1980 Erosion of Rock Shores at La Jolla, California
Marine Geology, Vol. 37, pp. 197-208.

Geotech. Ref: No. 33

Emery, K. O.; Kuhn, G. G.

1982 Sea Cliffs, Their Processes, Profiles and Classifications
Geological Society of American Bulletin, Vol. 93, pp. 644-654.

Geotech. Ref: No. 34

Emery, K. O.; Shepard, F. P.

1945 Lithology of the Sea Floor off Southern California
Geological Society of America Bulletin, Vol. 56, pp. 431-479.

Geotech. Ref: No. 35

Erickson, J. W.

1975 Petrology of Some Middle and Late Eocene Sandstones from the
Southern California Boderland
Paleogene Symposium and Selected Technical Papers,
Conference of Future Energy Horizons of the Pacific Coast,
Weaver, D.W. and Others, Eds., Annual Meeting AAPG-SEDM-SEG,
Long Beach, California. April 1975.

Geotech. Ref: No. 35A

Fall, E. W.

1981 Part A, Regional Geological History, Sediment Management
for Southern California Mountains,
Coastal Plains, and Shoreline
California Inst. of Tech., Environ. Qual. Lab. Report
No. 17-A, 33 pp.

Geotech. Ref: No. 36

Felix, D. W.

1969 Recent Sediments of Upper Submarine Canyon

M. S. Thesis, University of Southern California, Los Angeles.

Geotech. Ref: No. 37

Fisher, R. L.; Millo, R.

1952 Sediment Trap Studies of Sand Movement in La Jolla Bay

Geology Society of American Bulletin, Vol. 63, p. 1328.

Geotech. Ref: No. 38

Fulton, K.

1981 A Manual for Researching Historical Coastal Erosion

California Sea Grant College Program Institute of Marine Resources, University of California, La Jolla, 56 pps.

Geotech. Ref: No. 39

Gatto, L. W.

1970 Sediment Distribution on the Shelf, Slope and in Two Submarine Canyons of the Gaviota Area, Santa Barbara County, California

M. S. Thesis, University of Southern California, Los Angeles, California, 184 pp.

Geotech. Ref: No. 40

Goldman, H. B.

1964 Sand and Gravel in California, An Inventory of Deposits - Part B, Central California

Bulletin 180-B, California Division of Mines and Geology, Sacramento, California, 58 pp.

Geotech. Ref: No. 41

Gonzalez, D. J.

1970 Significance of Statistical Parameters in the Environmental Interpretation of Beach Sediments.
M. A. Thesis, University of California, Los Angeles, California.

Geotech. Ref: No. 42

Gorsline, D. S.

1968 Mineral Composition of River, Beach, and Shelf Sands from Point Conception, California, to the Mexican Border.
Abstracts for 1968, Geological Society of America, p. 115.

Geotech. Ref: No. 42A

Grant, D. J.

1973 Sediments of the San Pedro Shelf
M. S. Thesis, University of Southern California, Los Angeles, California, 93 pp.

Geotech. Ref: No. 43

Gutenberg, B.

1941 Changes in Sea Level, Postglacial Uplift, and Mobility of the Earth's Interior
Geological Society of America Bulletin, Vol. 52, pp. 721-772.

Geotech. Ref: No. 44

Hall, C. A.

1973 Geologic Map of the Morro Bay South and Port San Luis Quadrangles, San Luis Obsipo County, California

Geotech. Ref: No. 45

Haner, B. E.

1971 Morphology and Sediments of Redondo Submarine Fan, Southern Califorina
Geological Society of America, Vol. 82, pp. 2413-2432.

Geotech. Ref: No. 46

Haner, B. E.

1974 Redondo Submarine Canyon and Fan System
In: Guide Book to Selected Features of the Palos Verdes Peninsula and Long Beach, California; South Coast Geologic Society, Tustin, California, pp. 50-53.

Geotech. Ref: No. 47

Hart, M. W.

1979 Landslides and Debris Flows in San Diego County, California
In: Earthquakes and Other Perils, San Diego Region, P. L. Abbott and W. J. Elliott, Eds., San Diego Association of Geologists, San Diego, California, p. 167-182.

Geotech. Ref: No. 48

Heintz, L. O.

1966 Seasonal Distribution of Magnetite and Ilmenite in the Black Sand of Malaga Cove, California
M. A. Thesis, University of Southern California, Los Angeles, California, 138 pp.

Geotech. Ref: No. 48A

Hertlein, L. G.; Grant, U. S.

1954 Geology of the Oceanside - San Diego Coastal Area, Southern California in Geology of Southern California, Calif. Div. of Mines and Geology, Bull. 170, pps 53-63.

Geotech. Ref: No. 49

Hess, G. R.

1979 Miocene and Pliocene Inner Subrafan Channel Complex, San Clemente, California
Miocene Lithofacies and Depositional Environments, Coastal So. Calif., and Northwestern Baja Calif., Annual Meeting Geological Soc. of America, Pac. Sec., SEPM, Los Angeles, California, p. 99-105.

Geotech. Ref: No. 50

Hoots, H. W.

1931 Geology of the Eastern Part of the Santa Monica Mountains, Los Angeles, California
Professional Paper 165-C, U.S. Dept. of Interior, Geological Survey, Washington, D.C., 134 pp.

Geotech. Ref: No. 51

Howard, J. D.; Reineck, H.

1981 Depositional Facies of High-Energy Beach-to-Offshore Sequence: Comparison with Low-Energy Sequence
American Association of Petroleum Geologists Bulletin, Vol. 65, No. 5, pp. 807-830.

Geotech. Ref: No. 52

Ingle, J. C.

1965 The Movement of Beach Sand. An Analysis Using Fluorescent Grains

Developments in Sedimentology 5, Elsevier Publishing Co., N.Y.

Geotech. Ref: No. 53

Jennings, C. W.

1959 Santa Maria Sheet Geologic Map of California

California Division of Mines and Geology, Sacramento, California

Geotech. Ref: No. 54

Jennings, O. P.

1959 San Luis Obispo Sheet, Geologic Map of California

California Division of Mines and Geology, Scaremento, California

Geotech. Ref: No. 55

Jennings, O. P.

1962 Long Beach Sheet, Geologic Map of California

California Division of Mines and Geology, Sacramento, California

Geotech. Ref: No. 56A

Judge, C. W.

1970 Heavy Minerals in Beach and Stream Sediments as Indicators of Shore Process Between Monterey and Los Angeles

Technical Memo 33, Coastal Engr., Res., Center, U.S. Army Corps of Engineers, Ft. Belvoir, VA, 44 pp.

Geotech. Ref: No. 56

Jennings, O. P.; Strand, R. G.

1969 Los Angeles Sheet, Geologic Map of California
California Division of Mines and Geology, Sacramento,
California, one map.

Geotech. Ref: No. 57

Junger, A.; Wagner, H. C.

1977 Geology of the Santa Monica and San Pedro Basins, California
Continental Borderland
Misc. Field Studies Map, MF - 820, U.S. Dept., of Interior,
Geological Survey, Reston, Virginia.

Geotech. Ref: No. 58

Karl, H. A.

1976 Processes Influencing Transportation and Deposition of Sediment
on the Continental Shelf, Southern California
Ph.D. Thesis, University of Southern California, Los Angeles.

Geotech. Ref: No. 59

Karl, H. A.; Cacchione, D. A.; Drake, D. E.

1980 Erosion and Transport of Sediments and Pollutants in the Benthic
Boundary Layer on the San Pedro Shelf, Southern California
U.S. Geological Survey, Open-File Report No. 80-386 pp. ES-1 to
ES-6, and 1 to 54, 1 Appendix.

Geotech. Ref: No. 60

Kauffman, A. J.; Holt, D. C.

1965 Zircon - A Review; With Emphasis on West Coast Resources and Markets

Info. Circular No. 8268, U.S. Dept. of Interior, Bureau of Mines, 69 pp.

Geotech. Ref: No. 61

Keller, W. D.

1941 Size Distribution of Sand from Dunes, Beaches, and Some Sandstones

Geological Society of America Bulletin, Vol. 52, p. 1913

Geotech. Ref: No. 62

Kennedy, M. P.; Moore, G. W.

1971 Stratigraphic Relations of Upper Cretaceous and Eocene Formations, San Diego Coastal Area, California

American Association of Petroleum Geologists Bulletin, Vol. 55, No. 5, pp. 709-722.

Geotech. Ref: No. 63

Kennedy, M. P.

1973 Sea Cliff Erosion at Sunset Cliffs, San Diego

California Geology, Vol. 26, pp. 27-31.

Geotech. Ref: No. 64

Kern, J. P.

197 Origin and History of Upper Pleistocene Marine Terraces, San Diego, California
Geological Society of America Bulletin, Vol. 88, pp. 1553-1566.

Geotech. Ref: No. 65

Kies, R. P.

1982 Paleogeography of the Mount Soledad Formation West of the Rose Canyon Fault
In: Geologic Studies in San Diego, Field Trips, P. L. Abbott, Ed., San Diego Assoc. of Geologists, San Diego, California, pp. 1-11.

Geotech. Ref: No. 66-1

Konler, S. L.

1982 Classification of Sand and Gravel Resource Areas, San Gabriel Valley Production - Consumption Region
Special Report 143, Part IV, Calif., Div. of Mines and Geology Sacramento, California, 20 pp.

Geotech. Ref: No. 66-2

Konler, S. L.; Miller, R. V.

1982 Mineral Land Classification: Aggregate Material in the Western San Diego County, Production - Consumption Region
Special Report 153, Calif., Division of Mines and Geology, Sacramento, California, 28 pp.

Geotech. Ref: No. 67

Koide, M.; Soutar, A.; Goldberg, E.D.

1972 Marine Geochronology with PP-210.

Earth and Planetary Sciences Letters, Vol. 14, pp. 442-446

Geotech. Ref: No. 68

Krishnaswami, D. L.; Amin, B. S.; Soutar, A.

1973 Chronological Studies in Santa Barbara Basin

Liminology and Oceanography, Vol. 18, No. 5, pp. 763-770.

Geotech. Ref: No. 69

Kuhn, G. G.; Shepard, F. P.

1979 Accelerated Beach Cliff Erosion Related to Unusual Storms in Southern California

California Geology, California Division of Mines and Geology, Sacramento, California, pp. 58-95.

Geotech. Ref: No. 70

Kuhn, G. G.; Shepard, F. P.

1979 Coastal Erosion in San Diego County, California

In: Earthquakes and Other Perils, San Diego Region, P. L. Abbott and W. J. Elliott, Eds., San Diego Assoc., of Geologists, San Diego, California, pp. 207-216.

Geotech. Ref: No. 71

Kuhn, G. G.; Baker, E. D.; Campen, C.

1980 Greatly Accelerated Man-Induced Coastal Erosion and New Sources of Beach Sand, San Onofre State Park and Camp Pendleton, Northern San Diego County, California
Shore and Beach, pp. 9-13, October 1980.

Geotech. Ref: No. 72

Kuhn, G. G.; Shepard, F. P.

1980 Coastal Erosion in San Diego County, California
Coastal Zone '80, Hollywood, Florida; ASCE, N.Y., pp. 1899-1918.

Geotech. Ref: No. 73

Kuhn, G. G.; Shepard, F. P.

1983 Newly discovered Evidence from the San Diego County Area of Some Principles of Coastal Retreat
Shore and Beach, pp. 3-12, January 1983.

Geotech. Ref: No. 74

Le Feuer, R. D.; Anderhalt, R.; Reed, W. E.

1977 Trend Analysis of Textural Data from the Scuthern California Borderland
Geology Society of America, Vol. 9, No. 4, p. 451.

Geotech. Ref: No. 75

Link, M. H.; Howell, D. G.

1961 Conglomerate Facies, Eocene Fluvial to Shelf Submarine Channel Deposits, San Diego County, California
Geologic Society of America, Annual Meeting, Denver, Colorado, Vol. 8, No. 6, pp. 979-980.

Geotech. Ref: No. 76

La Joie, K. R.; Kern, J. P., Wellmiller, J. K.

1979 Quaternary Marine Shorelines and Coastal Deformation San Diego to Santa Barbara, California.
Geological Excursion in the Southern California Area, Abbott, P.L. ed., Dept. of Geological Sciences, San Diego State University, San Diego, California.

Geotech, Ref: No. 77

Larson, E. S.

1951 Crystalline Rocks of the Corona, Elsinore and San Luis Rey Quadrangles, Southern California.
California Division of Mines, Bulletin 159, pps 7-50.

Geotech. Ref: No. 78

Le Roy, S. D.

1981 Description of Grain-Size Curves From Sequences: A New Attempt
Ph.D. Thesis, University of Southern California, Los Angeles, California, 123 pp.

Geotech. Ref: No. 79

U.S.A.C.E., Los Angeles District

Osborne, R. H.

1982 Geomorphic and Sedimentologic Analysis for the Oceanside Project, 81 pps, 30 figs.

Geotech. Ref: No. 80

Maloney, N. J.

1982 Nearshore Sedimentation, Laguna Beach, California EOS, American Geophysics Union, Vol. 63, No. 3, p. 64

Geotech. Ref: No. 81

Malouta, D. A.

1978 Holocene Sedimentation in Santa Monica Basin, California M. S. Thesis, University of Southern California, Los Angeles.

Geotech. Ref: No. 82

Mann, J. F.

1951 The Sediments of Lake Elsinore, Riverside County, California Journal of Sediments Petrology, Vol. 21, No. 3, pp. 151-161.

Geotech. Ref: No. 83

McCrory, P. A.; La Joie, K. R.

1979 Marine Terrace Deformation, San Diego County, California Vol. 52, pp. 407-408.

Geotech. Ref: No. 84

McIntosh, W. L.; Eister, M. F.

1978 Geologic Map Index of California
U.S. Department of Interior, Geological Survey, Washington, D.C., 16, pp.

Geotech. Ref: No. 85

Miller, R. V.; Corpaley, R.

1981 Classification of Sand and Gravel Resource Areas. Orange County-Temescal Valley Production-Consumption Region
Special Report 143, California Division of Mines and Geology, Sacramento, California, 20 pp.

Geotech. Ref: No. 86

Minor, J. A.; Gibson, K. N.; Peterson, G. L.

1976 Clast Populations in the Sespe and Poway Conglomerates and Their Possible Bearing on the Tectonics of the Southern California, Borderland
In: Aspects of Geol. History of the Cont. Borderland, D. G. Howell, Ed., Misc. Pub. 24, Pac. Section, Amer. Assoc. of Pet. Geol., Bakersfield, Calif., pp. 256-325.

Geotech. Ref: No. 87

Mitchell, W. B.; et. al.

1977 A Geographic Information Retrieval and Analysis System for Handling Land Use and Cover Data
Professional Paper No. 1059, U.S. Dept. of Interior, Geological Survey, Reston, Virginia, 16 pp.

Geotech. Ref: No. 88

Mokhtari-Sognafi, M.; Osborne, R. H.

1980 An Economic Appraisal of Mining Offshore Sand and Gravel Deposits
Technical Report Studies, TR-80-01, Institute for Marine and Coastal Studies, University of Southern California, Los Angeles, California, 46 pp.

Geotech. Ref: No. 89

Moore, D. G.

1954 The Marine Geology of the San Pedro Shelf
Journal of Sedimentary Petrology, Vol. 27, pp. 162-181.

Geotech. Ref: No. 90

Morton, D. M.

1973 Geology of Parts of the Azusa and Mount Wilson Quadrangle, San Gabriel Mountains, Los Angeles County, California
Special Report 105, California Division of Mines and Geology, Sacramento, California, 21 pp.

Geotech. Ref: No. 91

Mudie, P. J.; Byrne, R.

1980 Pollen Evidence for Historic Sedimentation Rates in California Coastal Marshes
Estuarine and Coastal Marine Sciences, Vol. 10, pp. 305-316.

Geotech. Ref: No. 92

Nardin, T. R.

1983 Late Quaternary Depositional System and Sea Level Change-Santa Monica and San Pedro Basins, California Continental Borderland American Association of Petroleum Geologists, Bulletin, Vol. 67, No. 7, pp. 1104-1124.

Geotech. Ref: No. 93

Nilsen, T. H.; Abbott, P. L.

1977 Turbidite Sedimentology of the Upper Cretaceous Point Loma and Cabrillo Formations, San Diego, California In: Geological Excursions in the Southern California Area. P. L. Abbott, Ed., Annual Meeting, San Diego Geological Society, San Diego, California, pp. 139-166.

Geotech. Ref: No. 94

Normark, W. R.; Piper, D. J.

1969 Deep-Sea Fan Valleys, Past and Present Geology Society of America Bulletin, Vol. 80, pp. 1859-1866.

Geotech. Ref: No. 95

Nordstorm, C. E.; Inman, D. L.

1973 Beach and Cliff Erosion in San Diego County, California Studies on the Geology and Geologic Hazards of the Greater San Diego Area, California, San Diego Geological Society, San Diego State University, San Diego California, pps. 125-132.

Geotech. Ref: No. 96

Normark, W. R.; Piper, D. J.

1972 Sediments and Growth Pattern of Navy Deep-Sea Fan, San Clemente Basin, California Borderland

Journal of Geology, Vol. 80, pp. 198-223.

Geotech. Ref: No. 97

Norris, R. M.

1964 Dams and Beach-Sand Supply in Southern California

Papers in Marine Geology - Shepard Commemorative Volume, Chapter 9, Macmillan and Company, New York, pp. 154-171.

Geotech. Ref: No. 98

Oakeshott, G. B.

1958 Geology and Mineral Deposits of San Fernando Quadrangle, Los Angeles County, California

Bulletin 172, California Division of Mines and Geology, San Francisco, California, 139 pp.

Geotech. Ref: No. 99

Osborne, R. H.; Scheideman, R. C.; Nordin, T. R.; Harper, A. S.; Brodersen, K. L.; Kabakoff, J. and Waldron, J. M.

1979 Potential Sand and Gravel Resources in Santa Monica and San Pedro Bays; Southern California

Technical Report Series, Technical Report USC-SG-R-07-79, Institute for Marine and Coastal Studies, Univ. of Southern California, pps. 590-597.

Geotech. Ref: No. 100

Osborne, R. H.; Schrideman, R. C.; Nardin, T. R.; Harper, A. S.

1980 Quaternary Stratigraphy and Depositional Environments, Santa Monica Bay, Southern California
Technical Report Series, USC-SG-R-01-80. Institute for Marine and Coastal Studies, University of Southern California, Los Angeles, California, pp. 143-156.

Geotech. Ref: No. 101

Osborne, R. H.; Others

1983 Report of Potential Offshore Sand and Gravel Resources of the Inner Continental Shelf of Southern California
Department of Geological Sciences University of Southern California, Los Angeles, California, 303 pps with Appendix E, Map Sheets for Areas I through VIII, 27 plates, June 1983.

Geotech. Ref: No. 102

Page, R. W.

1963 Geology and Ground-Water Appraisal of the Naval Air Missile Test Center Area, Point Mugu, California
U.S. Dept. of Interior, Geological Survey, Water Supply Paper 1619-F, 35 pp.

Geotech. Ref: No. 103

Palmer, L. A.

1967 Marine Terraces of California, Oregon and Washington
Ph.D. Thesis, University of California at Los Angeles, California, 320 pp.

Geotech. Ref: No. 104

Peterson, C. H.

1976 Relative Abundances of Living and Dead Molluscs in Two California Lagoons
Lethaia, Vol. 9, pp. 137-148.

Geotech. Ref: No. 105

Piper, D. J.

1970 Transport and Deposition of Holocene Sediment on La Jolla Deep Sea Fan, California
Marine Geology, Vol. 8, pp. 211-227

Geotech. Ref: No. 106

Piper, J. W.; Normark, W. R.

1971 Re-Examination of a Miocene Deep-Sea Fan and Fan Valley, Southern California
Geologic Society of American Bulletin, Vol. 82, pp. 1823-1830

Geotech. Ref: No. 107

Pirie, D. M.; Steller, D. D.

1977 California Coastal Processes Study - Landsat II, Final Report
U.S. Dept. of Defense, Army Corps of Engineers, San Francisco District, San Francisco, California, 163 pp.

Geotech. Ref: No. 108

Ploessel, M. R.

1972 Sea Cliffs of Southern California: Malaga Cove to Dana Point, Geology and Geologic Hazards
M.A. Thesis, University of Southern California, Los Angeles, California, 110 pp.

Geotech. Ref: No. 109A

Radbruch, D. H.; Crowther, K. C.

1973 Maps Showing Areas of Estimated Relative Amounts of Landslides in California
Misc. Investigations Map I-747, U.S. Dept. of Interior, Geological Survey, Reston, Virigina

Geotech. Ref: No. 109

Putman, W. C.

1942 Geomorphology of the Ventura Region, California
Geologic Society of America Bulletin, Vol. 53, pp. 691-754.

Geotech. Ref: No. 110

Reeves, R. W.

1964 Modification of Drainage in the El Segundo Sand Hills of Coastal Southern California
M.A. Thesis, University of California at Los Angeles

Geotech. Ref: No. 111

Reynolds, S.; Smith, J.

1983 Sources of Sand on the Pocket Beaches of Palos Verdes Peninsula, California
The Compass of Sigma Gamma Epsilon, Vol. 61, No. 1, pp. 18-21.

Geotech. Ref: No. 112

Rice, R. M.; Gorsline, D. S.; Osborne, R. H.

1976 Relationships Between Sand Input from Rivers and the Composition of Sand from the Beaches of Southern California
Sedimentology, Vol. 23, pp. 689-703

Geotech. Ref: No. 113

Ritter, J. R.

1972 Cyclic Sedimentation in Agua Hedionda Lagoon, Southern California
Journal of Waterways and Harbors, Coastal Engineering Division,
ASCE, N.Y., Vol. 98, No. WW4, pp. 595-602.

Geotech. Ref: No. 114

Rogers, T. H.

1965 Geologic Map of California, Santa Ana Sheet
California Division of Mines and Geology, Sacramento, California

Geotech. Ref: No. 115

Roig, J. H.

1976 Use of Heavy Minerals as Tracers of Sand Transport on the Santa
Barbara - Oxnard Shelf, Santa Barbara Channel, California
M.S. Thesis, University of Southern California, Los Angeles,
California, 83 pp.

Geotech. Ref: No. 116

Sarna-Wojoicki, A. M.; Williams, K. M.; Yerkes, R. F.

1976 Geology of the Ventura Fault, Ventura County, California
Misc. Field Studies Map, MF - 781, U.S. Dept. of Interior,
Geological Survey, Menlo Park, California

Geotech. Ref: No. 117

Savula, N. A.

1978 Light Mineral Petrology of Sediments from Santa Monica and
San Pedro Bays, California Continental Borderland
M.S. Thesis, University of Southern California, Los Angeles

Geotech. Ref: No. 118

Scheidemann, R. C.; Kuper, H. T.

1979 Stratigraphy and Lithofacies of the Sweetwater and Rosarito Beach Formations, Southwestern San Diego County, California, and New Baja California, Mexico
In: A Guide to Miocene Lithofacies and Depositional Environments, Coastal Southern California and Northwestern Baja, Calif., Pac., Section, SEPM, Bakersfield, California, pp. 107-118.

Geotech. Ref: No. 119

Scherr, J. M.

1981 Sedimentary Structures in Vibra-Cores from the Oxnard Shelf
M.S. Thesis, University of Southern California, Los Angeles, California, 157 pp.

Geotech. Ref: No. 120

Schwartz, R. K.

1982 Bedform and Stratification Characteristics of Some Modern Small-Scale Washover Sand Bodies
Sedimentology, Vol. 29, pp. 835-849.

Geotech. Ref: No. 121

Scott, D. B.; Mudie, P. J.; Bradshaw, J. S.

1976 Benthonic Foraminifera of Three Southern California Lagoons: Ecology and Recent Stratigraphy
Journal of Foraminiferal Research, Vol. 6, No. 1, pp. 59-75.

Geotech. Ref: No. 122

Scott, R. M.; Williams, R. P.

1978 Erosion and Sediment Yields in the Transverse Ranges, Southern California

U.S. Dept. of Interior, Geological Survey, Washington, D.C., Professional Paper, 1030, 38 pp.

Geotech. Ref: No. 123

Shepard, F. P.

1932 Sediments of the Continental Shelves

Geologic Society of America Bulletin, Vol. 43, pp. 1017-1040.

Geotech. Ref: No. 124

Shepard, F. P.

1979 Currents in Submarine Slopes, L. J. Doyle and O. H. Pilkey

Special Publication No. 27, Society of Economic Paleo. and Mineralogists, Tulsa, Okla., pp. 85-94.

Geotech. Ref: No. 125

Shepard, F. P.; Young, R.

1961 Distinguishing Between Beach and Dune Sands

Journal of Sedimentary Petrology, Vol. 31, No. 2, pp. 196-214.

Geotech. Ref: No. 126

Shepard, F. P.; et. al.

1969 Physiography and Sedimentary Processes of La Jolla Submarine Fan and Fan Valley, California

American Association of Petroleum Geologists Bulletin, Vol. 53, No. 2, pp. 390-420.

Geotech. Ref: No. 127

Shlemon, R. J.

1977 Late Pleistocene Channel of the Lower Santa Margarita River, San Diego County, California
In: Geologic Guide to San Onofre Nuclear Generating Station and Adjacent Regions of So. California, D. L. Fife, Ed., Pac. Sec. Amer. Assoc. of Pet. Geo., Bakersfield, Calif., pp. A-63-A-70.

Geotech. Ref: No. 128

Smoote, V. A.;

1979 Edgewater Towers Project
In: Field Guide to Selected Engineering Geologic Features, Santa Monica Mountains, J. R. Keaton, Ec., Assoc. of Eng. Geologists, Southern California Section, Los Angeles, Calif., pp. 76-99.

Geotech. Ref: No. 129

South Coast Regional Commission

1974 The Geology Element for the South Coast Region
South Coast Regional Commission, Regional Element III, California Coastal Zone Conservation Plan, Long Beach, California, 145 pp.

Geotech. Ref: No. 130

Spear, S. G.

1971 Geologic Mapping of Erosional Susceptibility
M.S. Thesis, University of Southern California, Los Angeles

Geotech. Ref: No. 131

Speidel, W. C.

1975 Nearshore Sediment at San Onofre, California
In: Studies on the Geology of Camp Pendleton and Western San Diego County, California, A. Ross and R. J. Dowlen, Eds., San Diego Association of Geologists, San Diego, Calif., pp. 36-47.

Geotech. Ref: No. 132

Spotts, J. H.

1962 Zircon and Other Accessory Minerals, Coast Ranges Batholith, California
Geologic Society of America Bulletin, Vol. 73, pp. 1221-1240.

Geotech. Ref: No. 133

Stewart, C. J.

1979 Lithofacies and Origin of the San Onofre Breccia, Coastal California
In: Miocene Lithofacies and Depositional Environments, Coastal Southern California and NW Baja California, Geological Society of America, AAPG-SEPM-SEG, Bakersfield, Calif., pp. 25-42.

Geotech. Ref: No. 135

Stoney, G. F.; Nicoll, G. A.; Dablow, J.

1977 Bluff Stability and Urbanization of the Upper Newport Bay Area, Newport Beach, California
Abstract; Geologic Society of America, Vol. 9, No. 4, p. 509.

Geotech. Ref: No. 136

Stoutar, A.; Crill, P. A.

1977 Sedimentation and Climatic Patterns in the Santa Barbara Basin During the Nineteenth and Twentieth Centuries
Geologic Society of America Bulletin, Vol. 88, pp. 1161-1172.

Geotech. Ref: No. 137

Strand, R. G.

1962 San Diego - El Centro Sheet, Geologic Map of California
California Division of Mines and Geology, Sacramento, California.

Geotech. Ref: No. 137A

Taylor, B. D.

1978 Sediment Management for Southern California
Coastal Zone '78, Symposium on Technical, Environmental, Socio-economic and Regulatory Aspects of Coastal Zone Management, San Francisco, California, ASCE, Volume 3, pp. 2259-2264, March.

Geotech. Ref: No. 137B

Taylor, B. D.

1981 Inland Sediment Movements by Natural Processes
Environmental Quality Laboratory, California Institute of Technology, Pasadena, California. EQL Report No 17-B; 81 pages.

Geotech. Ref: No. 138

Terry, R. D.

1955 Bibliography of Marine Geology and Oceanography, California Special Report 44, California Division of Mines and Geology, San Francisco, California, 131 pp.

Geotech. Ref: No. 139

Thompson, W. O.

1937 Original Structures of Beaches, Bars and Dunes Geologic Society of America Bulletin, Vol. 48, pp. 723-752.

Geotech. Ref. No. 140A

Trask, P. D.

1955 Movement of Sand Around Southern California, Promontories Report No. TR-76, Coastal Engineering Research Center, Ft. Belviour, VA.

Geotech. Ref: No. 140

Todd, V.; Hoggatt, W. C.

1979 Vertical Tectonics in the Elsinore Fault Zone Abstract; Geological Society of America Annual Meeting, San Diego, California, p. 528.

Geotech. Ref: No. 141

Upson, J. E.

1951 Former Marine Shorelines of the Gaviota Quadrangle, Santa Barbara County, California Journal of Geology, Vol. 59, pp. 415-446.

Geotech. Ref: No. 142

U.S.A.C.E., Los Angeles District

1952 Coast of California, Carpinteria to Point Mugu, Beach Erosion Control Study, Appendix 4
U.S. Army Corps of Engineers, Los Angeles District, California, House Document 29, Appendix I, 82nd Congress, 1st Session, pp. 63-84.

Geotech. Ref: No. 143

U.S.A.C.E., Los Angeles District

1961 Geology, Drainage and Littoral Materials, Appendix B
Beach Erosion Control Report on Coast of Calif., Appx. VII.
U.S. Army Corps of Engineers, Los Angeles, California, House Document 458, 87th Congress, 2nd Session, pp. 50-61.

Geotech. Ref: No. 143A

U.S.A.C.E., Los Angeles District; Osborne, R. H.

1982 Geomorphic and Sedimentologic Analysis for the Oceanside Project, 81 pps, 30 figs.

Geotech. Ref: No. 143B

U.S.A.C.E, Los Angeles District

1984 Monitoring Program Littoral Zone Sediments Oceanside Harbor Experimental Sand Bypass System
Army Corps of Engineers, Los Angeles District, Los Angeles, California, 35 pps.

Geotech. Ref: No. 143C

U.S.A.C.E., Los Angeles District

1984 Sediment Sampling Dana Point to Mexican Border (Task 1D, Nov-83 to Jan-84)
Coast of California Storm and Tidal Waves Study, Los Angeles District, Los Angeles, California, 35 pps.

Geotech. Ref: No. 143D

U.S.A.C.E., Los Angeles District

1984 Geomorphology Framework Report Dana Point to the Mexican Border
Coast of California Storm and Tidal Waves Study, Army Corps of Engineers, Los Angeles, District, Los Angeles, California, 200 pp.

Geotech. Ref: No. 143E

U.S.A.C.E, Los Angeles District

1970 Cooperative Research and Data Collection Program, Coast of Southern California, Three Year Report 1967-1969, Los Angeles District, Los Angeles, California, 20 pp, Appendix A-F.

Geotech. Ref: No. 144

U.S. Dept. of the Interior, BLM

1984 Surface Management Maps
U.S. Dept. of Interior, Bureau of Land Management, Sacramento, California, 12 maps.

Geotech. Ref: No. 145

U.S. Dept. of Interior, GS

1984 Digital Line Graph (DLG) and Digital Evaluation Data (DEM)
U.S. Dept. of Interior, Geological Survey, Reston, Virginia.

Geotech. Ref: No. 145A

U.S. Dept. of Interior, GS

1983 Index to Land Use and Land Cover Information
U.S. Dept. of Interior, Geological Survey, Reston, Virginia.

Geotech. Ref: No. 145B

U.S. Dept. of Interior, GS

1980 Land Use and Land Cover Map, 1972-1975, San Diego, California
Map L-125, U.S. Dept. of Interior, Geological Survey, Reston, Virginia.

Geotech. Ref: No. 145C

U.S. Dept. of Interior, GS

1978 Land Use and Land Cover and Associated Maps
General Interest Publication, U.S. Dept. of Interior, Geological Survey, Reston, Virginia, 6 pp.

Geotech. Ref: No. 145D

U.S. Dept. of Interior, GS

1976 Land Use and Land Cover Map, 1972-1975, Santa Ana, California
Open File Map 75-114-1, U.S. Dept. of Interior, Geological Survey, Reston, Viriginia.

Geotech. Ref: No. 146A

Vedder, J. G.; Beyer, L. A.; Junger, A.; Moore, G. W.

1974 Preliminary Reports on the Geology of the Continental Borderland of Southern California.
Map MF-624, U.S. Dept. of Interior, Gerlogical Survey, Reston, Virginia, 34 pp.

Geotech. Ref: No. 147

Vanderhurst, W. L.; McCarthy, R. J.; Hannan, D. L.

1982 Black's Beach Landslide

In: Geologic Studies in San Diego, P. L. Abbott; Ed., San Diego Association of Geologists Field Trips, April 1982, San Diego Association of Geologists San Diego, California, 11 pp.

Geotech. Ref: No. 148

Vedder, J. G.; Beyer, L. A.; Junger, A.; Moore, G. W.

1974 Preliminary Report or the Geology of the Continental Borderland of Southern California.

U.S. Geological Survey, Reston VA., 34 pps, Misc. Field Inves. Map MF-624.

Geotech. Ref: No. 149

Vedder, J. G.; Yerkes, R. F.; Schoellnamer, J. E.

1957 Geologic Map of the San Joaquin Hills - San Juan Capistrano Area Orange County, California.

Oil and Gas Map, OM-193, U.S. Dept. of Interior, Geological Survey, Reston, Virginia.

Geotech. Ref: No. 150

Vernon, J. W.

1966 Shelf Sediment Transport System

Ph.D. Thesis, University of Southern California, Los Angeles, California, 135 pp.

Geotech. Ref: No. 151

Walawender, M. J.

1975 Petrogenesis of the Gabbro-Tonalite Sequence in the Pilgrim Creek-Morrow Hill Area, Camp Pendleton, California. In: Studies on the Geology of Camp Pendleton and Western San Diego County, California, A. Ross and R. J. Dowler, Eds., San Diego Assoc. of Geologists, San Diego, Calif., pp. 28-32.

Geotech. Ref: No. 152

Welsh, R.; Bryant, G. L.; Einert, M. P.

1984 Draft Supplemental Enviromental Statement, Santa Margarita Project, San Diego, California. U.S. Dept. of Interior, Bureau of Reclamation, Boulder City.

Geotech. Ref: No. 153

Weber, F. H.; Cleveland, G. B.; Kanle, J. E.; Kiessling, E. F.

1973 Geology and Mineral Resource Study of Southern Ventura County Preliminary Report 14, California Division of Mines and Geology, Los Angeles, California.

Geotech. Ref: No. 154

Weber, F. H.

1963 Geology and Mineral Resources of San Diego County, California County Report 3, California Division of Mines and Geology, Sacramento, California, 309 pp.

Geotech. Ref: No. 155

Weber, F. H.

1973 Geology and Mineral Resources Study of Southern Ventura County, California.
Preliminary Report 14, California Division of Mines and Geology, Sacramento, California, 102 pp.

Geotech. Ref: No. 156

Welday, E. E.; Williams, J. W.

1975 Offshore Surficial Geology of California.
Map Sheet 26, California Division of Mines and Geology, Sacramento, California.

Geotech. Ref: No. 157

Weigel, R. L.; Patrick, D. A.; Kimberley, H. L.

1954 Wave, Long Shore Currents, and Beach Profile Records for Santa Margarita River, Oceanside, California.
American Geophysical Union, Vol. 35, No. 6 Part 1, pp. 887-896.

Geotech. Ref: No. 158

Weser, O. E.

1971 Proximal Turbidite Environment, San Clemente State Park
In: Geologic Guide Book, Newport Lagoon to San Clemente, Calif., Coastal Exposures of Miocene and Early Pliocene Rocks, pp. 1-26.

Geotech. Ref: No. 159

Willis, D. K.

1979 Texture Comparison of Insular and Mainland Shelf Sediments, Continental Borderland, California.
M. S. Thesis, University of Southern California, Los Angeles.

Geotech. Ref: No. 160

Wimberly, S.

1964 Sediments of the Southern California Mainland Shelf
Ph.D. Thesis, University of Southern California, Los Angeles.

Geotech. Ref: No. 161

Winter, E. L.; Durham, D. L.

1962 Geology of the Southeastern Ventura Basin, Los Angeles, County, California.
Professional Paper 334-H, U.S. Dept. of Interior, Geological Survey, Washington, D. C., 366 pp.

Geotech. Ref: No. 162

Wood, S. H.; Elliott, M. R.

1979 Early 20th Century Uplift of the Northern Peninsular Ranges Province of Southern California.
Tectonophysics, Vol. 52, pp. 249-265.

Geotech. Ref: No. 162A

Woodring, W. P.; Bramlette, M. W.

1950 Geology and Paleontology of the Santa Monica District California.
U.S. Geological Survey Prof. Paper 222, pps 1-185.

Geotech. Ref: No. 163

Worts, G. F.

1951 Geology and Ground Water Resources of the Santa Maria Valley Area, California

Water Supply Paper 1000, U.S. Dept. of Interior, Geological Survey, Washington, D. C., 169 pp.

Geotech. Ref: No. 164

Yancy, T. E.; Lee, J. W.

1972 Major Heavy Mineral Assemblages and Heavy Mineral Province of the Central California Coast Region.

Geologic Socity of America Bulletin, Vol. 83, pp. 2099-2104.

Geotech. Ref: No. 165

Yerkes, R. F.; Lee, W. H.

1979 Maps Showing Faults, Fault Activity and Epicenters, Focal Depths and Focal Mechanics for 1970-75 Earthquakes, Western Transverse Range, California.

Map Sheets MF-1032, U.S. Dept. of Interior, Geological Survey Reston, Virginia.

Geotech. Ref: No. 166

Yerkes, R. F.; Campbell, R. H.

1980 Geologic Map of East-Central Santa Monica Mountains, Los Angeles County, California.

Miscellaneous Investigations Series, Map I-1146, U.S. Dept. of Interior, Geological Survey, Washington, D. C.

Geotech. Ref: No. 166A

Yerkes, R. F.; Greene, H. G.; Tinsley, J. C.; La Jole, K. R.

1981 Seismotectonic Setting of the Santa Barbara Channel Area, Southern California.
Miscellaneous Field Investigations Map, MF-1169, U.S. Dept. of Interior, Geological Survey, Reston, Virginia.

Geotech. Ref: No. 167

Yudovin, S. M.

1979 Texture and Mineralogy of Heavy Mineral Enriched Beach Sand, Dockweiller State Beach, Southern California.
M. S. Thesis, University of Southern California, Los Angeles, California, 111 pp.

Geotech. Ref: No. 168

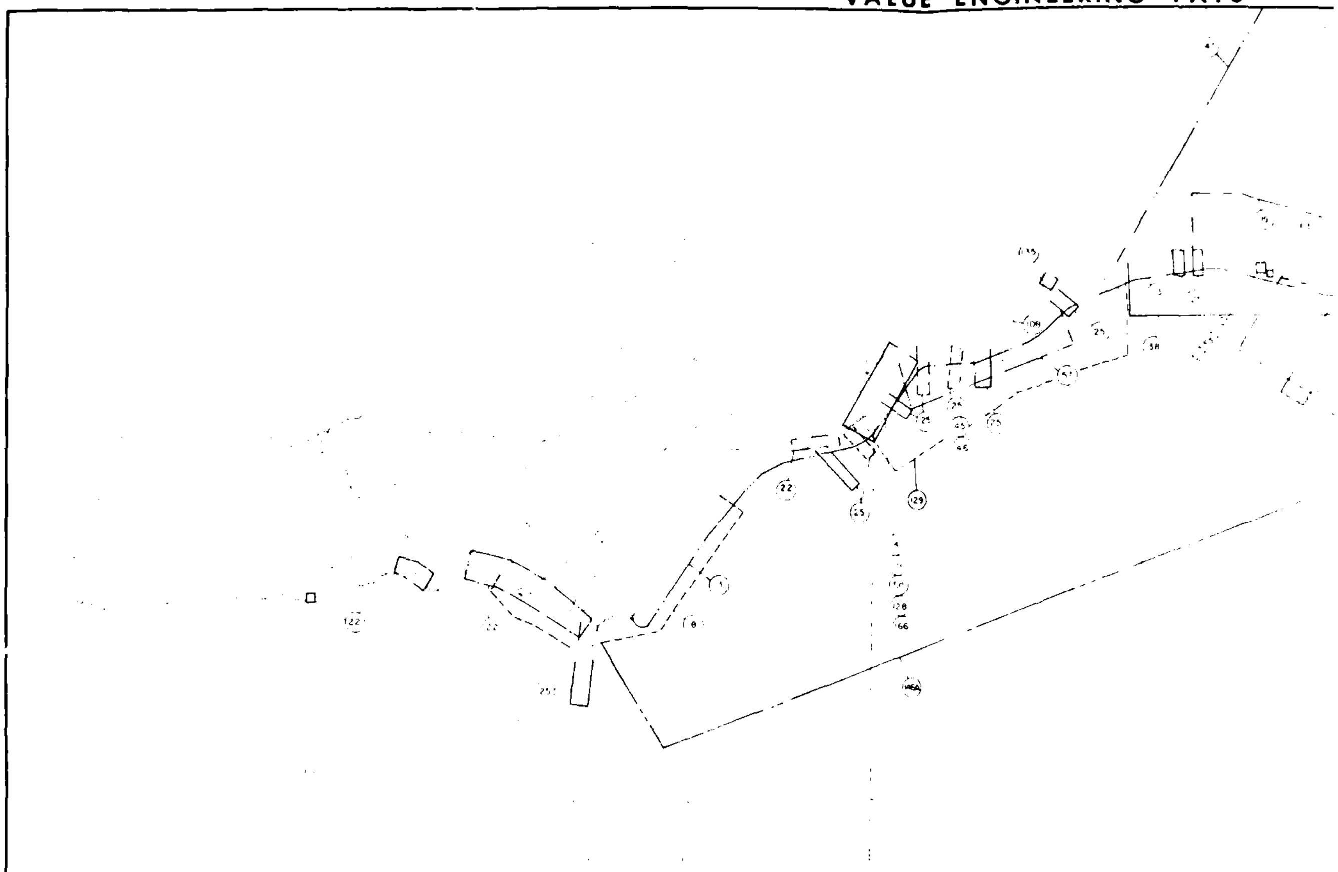
Ziony, J. I.; Wentworth, C. M.; Buchanan-Banks, J. M.; Wagner, H. C.

1974 Preliminary Map Showing Regency of Faulting in Coastal Southern California.

Geotech. Ref: No. 170

Zlotnik, E.

1979 Map of Cretaceous Turbidite Facies, Point Loma Peninsula
In: Geologic Excursions in the Southern California Area, P. L. Abbott, Ed., Dept. of Geological Sciences, San Diego State Univ., San Diego, California, pp. 167-185.



SOUTH CENTRAL REGION

SUBREGION VI

INVENTORY TOPIC

STABLE UNSTABLE LANDFORMS	DUNES	BLUFFS CLIFFS	SLIDES
[illegible]	[illegible] %	[illegible] %	L 40 % M 50 % H [illegible] %

OFFSHORE BATHYMETRIC FEATURES

BEACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
Morro Bay	[illegible]	[illegible]	[illegible]	80 %	20 %
Santa Ynez River			[illegible]	10 %	20 %
Santa Maria River	None			20 %	80 %

SUBREGION VII

STABLE UNSTABLE LANDFORMS	DUNES	BLUFFS CLIFFS	SLIDES
22 [illegible]	[illegible] %	NONE	L [illegible] % MO [illegible] % H [illegible] %

OFFSHORE BATHYMETRIC FEATURES

BEACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
SANTA BARBARA	3	22	2	50 %	[illegible] %

SOUTH COAST REGION

SUBREGION VIII

STABLE UNSTABLE LANDFORMS	DUNES	BLUFFS CLIFFS	SLIDES
[illegible] 22 [illegible]	[illegible] %	NONE	[illegible]

OFFSHORE BATHYMETRIC FEATURES

BEACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
SANTA MONICA	[illegible]	[illegible]	[illegible]	40 %	60 %

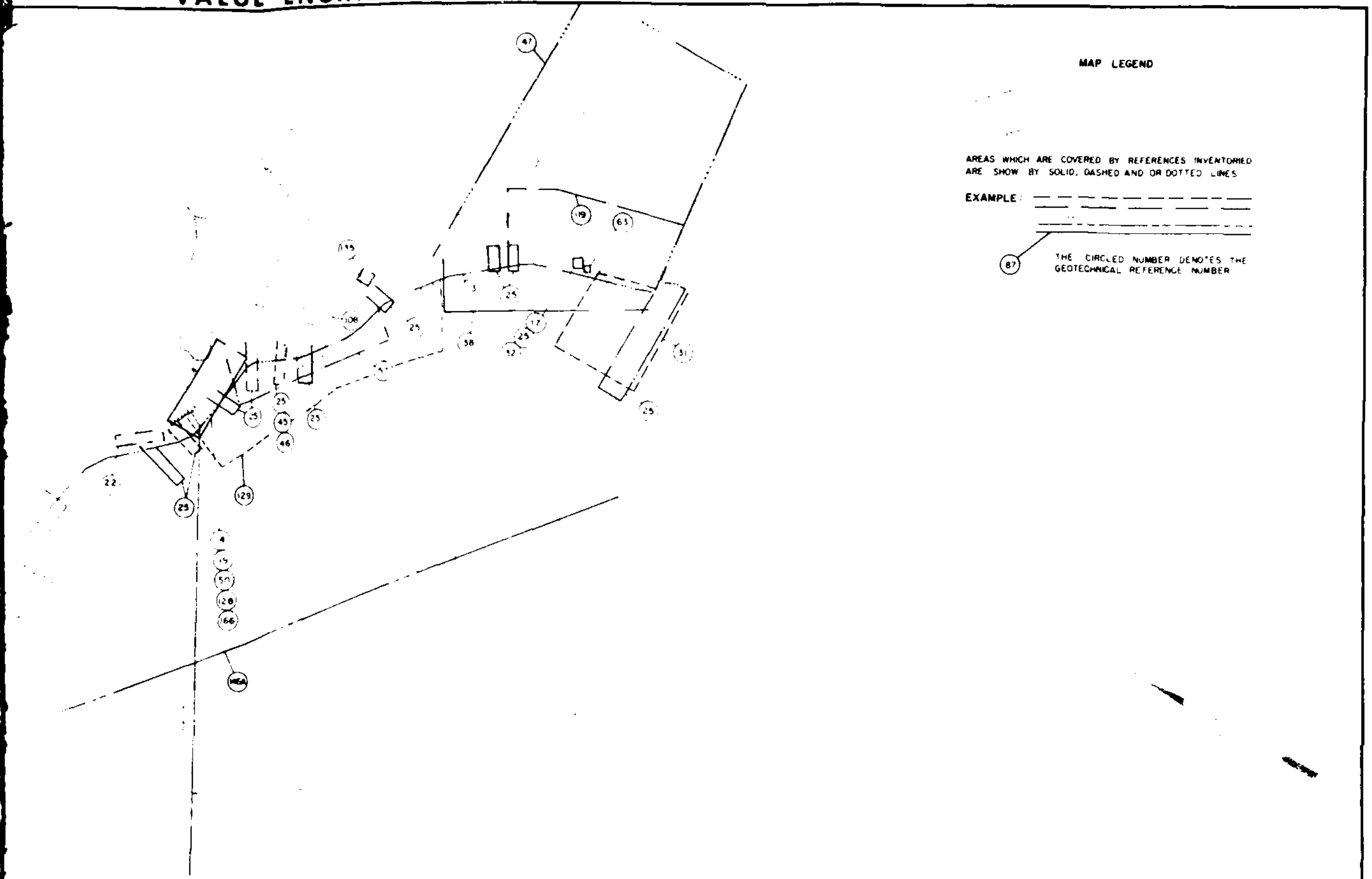
NOTES

1. THE FOLLOWING ITEMS WERE NOT PLOTTED
   [illegible]
   A
2. FOR AN EXPLANATION OF THE INVENTORY CATAGORIES (DUNES, BLUFFS, CLIFFS, SLIDES, ETC.) SEE THE APPROPRIATE SECTIONS OF THE INVENTORY REPORT

ABBREVIATIONS

M MARINE
L LOW
MO MODERATE
H HIGH
? A QUESTION MARK INDICATES THAT THE VALUE SHOWN IS AN APPROXIMATE VALUE

VALUE ENGINEERING PAYS



SOUTH COAST REGION

SUBREGION VIII

STABLE-UNSTABLE LANDFORMS: 14, [illegible], 22, 108, 128, 129, 29A

DUNES	CLIFFS	SLIDES
[illegible] %	NONE	[illegible] 80 % MO [illegible] % H [illegible] %

OFFSHORE BATHYMETRIC FEATURES: 1, 25, 45, 46, [illegible], 46A, 156

CELL REACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
SANTA MONICA	[illegible]	[illegible]	[illegible]	40 %	60 %

SUBREGION IX

STABLE-UNSTABLE LANDFORMS: 108, 128, [illegible], 29A

DUNES	CLIFFS	SLIDES
NONE	[illegible] %	L 70 % MO 5 % H 25 %

OFFSHORE BATHYMETRIC FEATURES: [illegible], [illegible], 51, 46A, 156

CELL REACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
SAN PEDRO	3	2 2	[illegible]	15 %	85 %

SAN DIEGO REGION

SUBREGION X

STABLE-UNSTABLE LANDFORMS: 32, 38, 47, 63, 129, 109A

DUNES	CLIFFS	SLIDES
3 %	80 %	L 85 % MO 10 % H 5 %

OFFSHORE BATHYMETRIC FEATURES: 13, 17, 25, 31, 146A, 156

CELL REACH	Submarine Canyons Total	Active	Inactive	Near Shore Morphology Rocks	Sandy
Oceanside	3	1	2 2	50 %	50 %
Mission Bay	None	–	–	40 %	60 %
Silver Strand	1	–	2 1	0 %	100 %

COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

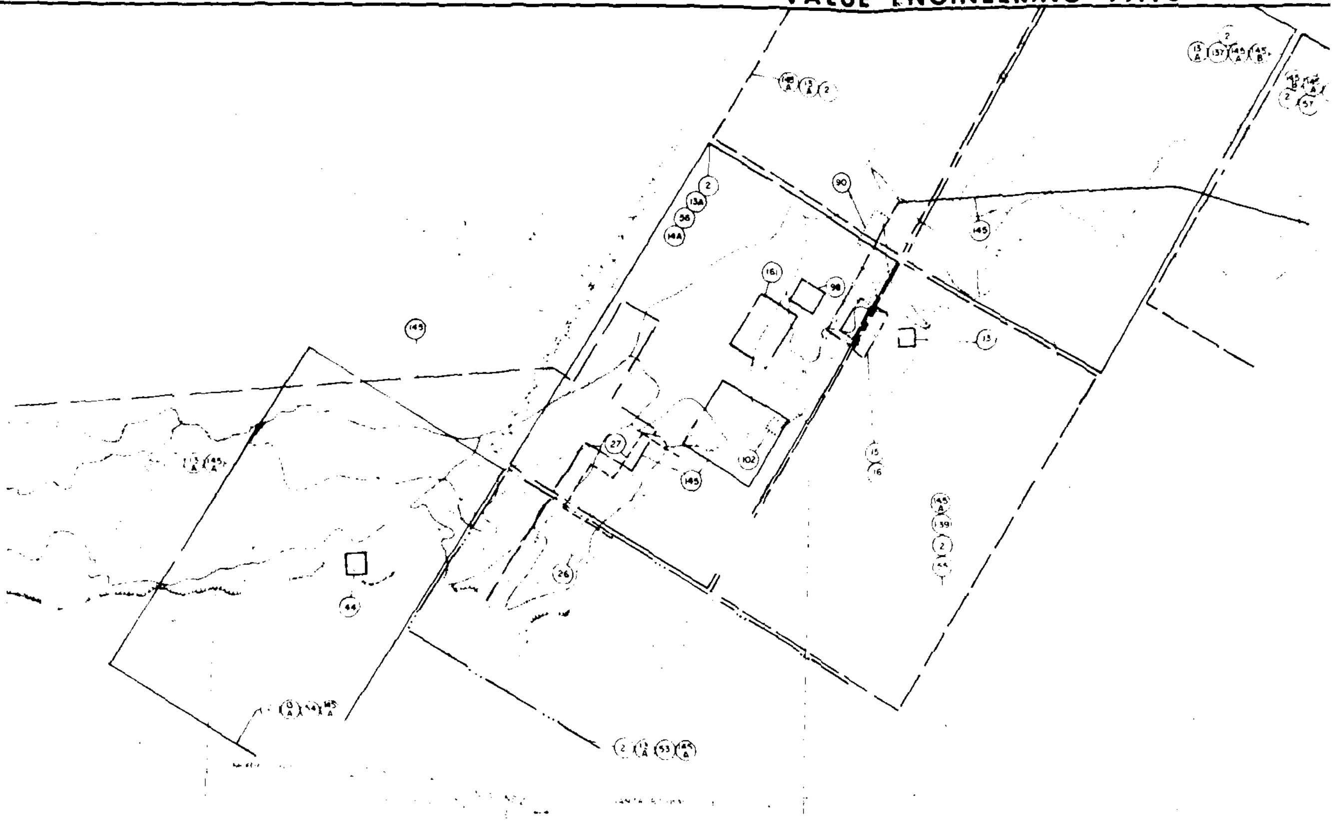
LITTORAL ZONE CELLS AND DATA INVENTORY COASTAL GEOLOGICAL FEATURES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 1

SAFETY PAYS

VALUE ENGINEERING PAYS



SOUTH CENTRAL REGION

SUBREGION VI

DESCRIPTIVE GEOLOGY RIVER BASINS

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
44 53 54	Morro Bay	CM CP	5	UNK
INDEX Biblo 84 138	Santa Ynez River	CM - CP	5	UNK
	Santa Maria River	CM - CP	5	UNK

DIGITAL BASE MAPS 145 Digital maps only, see index for exact current coverage

LAND USE 2 13 A 145 A 87 144

SUBREGION VII

DESCRIPTIVE GEOLOGY RIVER BASINS

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
26 27 53 56 102 161				
INDEX Biblo 84 138	Santa Barbara	CM - IV	5	5,700

DIGITAL BASE MAPS 145 Digital maps only, see index for exact - current coverage

LAND USE 2 13 A 145 A 87 144

SOUTH COAST REGION

SUBREGION VIII

DESCRIPTIVE GEOLOGY RIVER BASINS

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
15 16 18 50 55 156				
98 166 90	Santa Monica	CM - CP	2 - 5	340

INDEX Biblo 84 138

DIGITAL BASE MAPS 145 Digital maps only, see index for exact-current coverage

LAND USE 2 13 A 145 A 87 144

SUBREGION

DESCRIPTIVE GEOLOGY RIVER BAS

55

CELL REACH

INDEX Biblo 84 138 SAN PEDRO

DIGITAL BASE MAPS 145 Digital maps

LAND USE 2 13 A 145 A 87 144

NOTES

1. THE FOLLOWING ITEMS WERE NOT PLOTTED
   84 87 138 144 146
2. FOR AN EXPLANATION OF THE INVENTORY CATAGORIES ("GEOMORPHIC CLASSIFICATION," "GEOLOGIC INDEX", OR "BASIN PRODUCTION") SEE THE APPROPRIATE SECTIONS OF THE INVENTORY REPORT
3. SEE THE INVENTORY DATA SHEETS FOR DESCRIPTIVE GEOLOGY FOR SEDIMENT BASIN PRODUCTION DATA FOR EACH DRAINAGE BASIN THAT DRAINS INTO THE ADJACENT CELL OR SUBREGION
4. BASIN PRODUCTION VALUES ARE IN 1,000 OF CUBIC YARDS PER YEAR

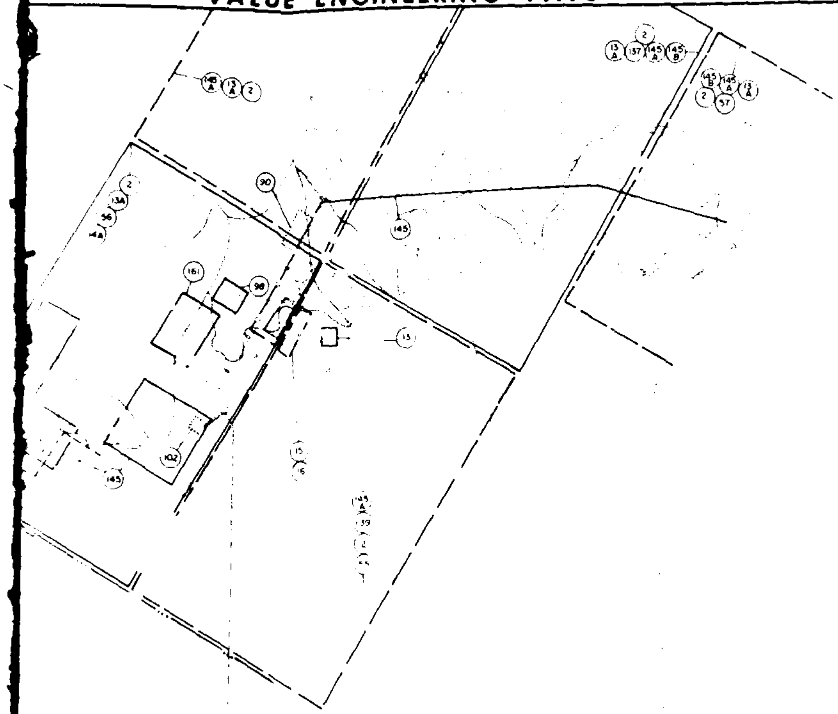
ABBREVIATIONS

CF COASTAL FOOTHILLS
CM COASTAL MOUNTIANS
CP COASTAL PLAIN
IV INLAND VALLEY
IM INLAND MOUNTIAN
CM-CP GEOMORPHIC CLASSIFICATION
5 GEOLOGIC INDEX
UNK UNKNOWN

1 INCH EQUALS APPROXIMATELY

SAFETY PAYS

VALUE ENGINEERING PAYS



MAP LEGEND

AREAS WHICH ARE COVERED BY REFERENCES INVENTORIED ARE SHOW BY SOLID, DASHED AND OR DOTTED LINES

EXAMPLE:

87 THE CIRCLED NUMBER DENOTES THE GEOTECHNICAL REFERENCE NUMBER

SOUTH COAST REGION

SUBREGION VIII

DESCRIPTIVE GEOLOGY RIVER BASINS

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
15 16 18 50 55 56 98 166 90	Santa Monica	CM - CP	2 - 5	34

INDEX Biblo 84 138

DIGITAL BASE MAPS 145 Digital maps only, see index for exact-current coverage

LAND USE 2 15 A 145 A 87 144

SUBREGION IX

DESCRIPTIVE GEOLOGY RIVER BASINS

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
55 INDEX Biblo 84 138	SAN PEDRO	IV M	5	4,420

DIGITAL BASE MAPS 145 Digital maps only, see index for exact current coverage

LAND USE 2 15 A 145 A 87 144 145

SAN DIEGO REGION

SUBREGION X

DESCRIPTIVE GEOLOGY RIVER BASIN

	CELL REACH	Geomorphic Classification	Geologic Index	Basin Production
114 117 INDEX Biblo 84 138	Oceanside	CP - CM	3	2,860
	Mission Bay	CM	5	580
	Silver Strand	CP	3	2,080

DIGITAL BASE MAPS 145 Digital maps only, see index for exact-current coverage

LAND USE 2 15 A 145 B 145 87 144

ABBREVIATIONS

CF COASTAL FOOTHILLS
CM COASTAL MOUNTAINS
CP COASTAL PLAIN
IV INLAND VALLEY
IM INLAND MOUNTIAN
CM-CP GEOMORPHIC CLASSIFICATION
5 GEOLOGIC INDEX
UNK UNKNOWN

INCH EQUALS APPROXIMATELY 16 MILES

COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

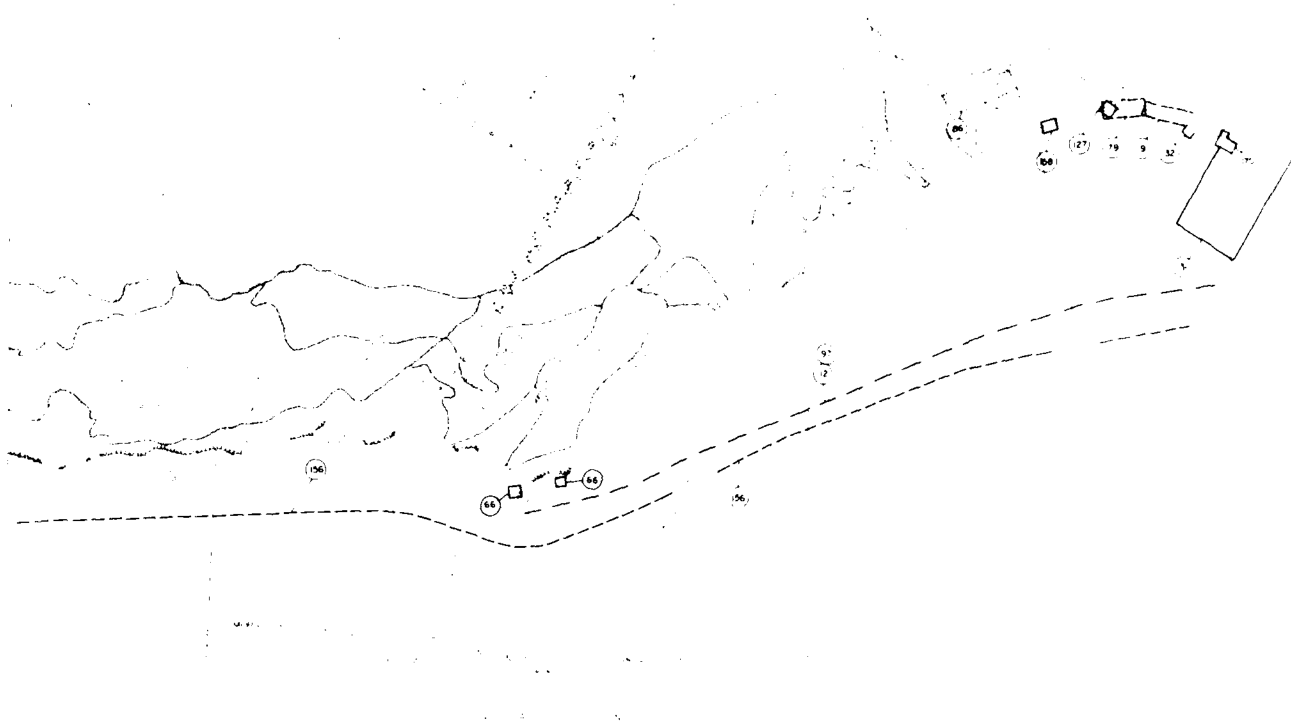
LITTORAL ZONE CELLS AND DATA INVENTORY

DESCRIPTIVE GEOLOGY RIVER BASINS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SAFETY PAYS

PLATE 2



SOUTH CENTRAL REGION

SUBREGION VI

CELL	MORRO BAY S	P	VOL	SANTA MARIA S	P	VOL	SANTA YNEZ S	P	VOL
SEDIMENT SOURCE DRAINAGE BASIN	S			S	70 ?	475 CY/y	L	50	55
CLIFFS									
SEDIMENT SINK									
RIVER	S			S			S		
LAGOON									
DUNE	S	100	unk	S	100	151 CY/y	S	100	55
CONT SHELF	M	50		S	50 ?		S	50 ?	
SUBMARINE CANYON									
66 156									

SUBREGION VII

CELL	SANTA BARBARA S	P	VOL
SEDIMENT SOURCE DRAINAGE BASIN			
CLIFFS	S		25
SEDIMENT SINK			
RIVER	S		
LAGOON			
DUNE	S	100	600
CONT SHELF	S		
SUBMARINE CANYON			
12 66 97 156			

SOUTH COAST REGION

SUBREGION VIII

CELL	SANTA MONICA S	P	VOL
SEDIMENT SOURCE DRAINAGE BASIN			
CLIFFS			
SEDIMENT SINK			
RIVER			
LAGOON			
DUNE	S		ACTIVE (?)
CONT SHELF	S	50 ?	
SUBMARINE CANYON	S		
12 97 156			

SUBREGION

CELL	S	P
SEDIMENT SOURCE DRAINAGE BASIN		
CLIFFS	S	[illegible]
SEDIMENT SINK		
RIVER		
LAGOON		
DUNE		
CONT SHELF	[illegible]	[illegible]
SUBMARINE CANYON	[illegible]	
[illegible]		

NOTES

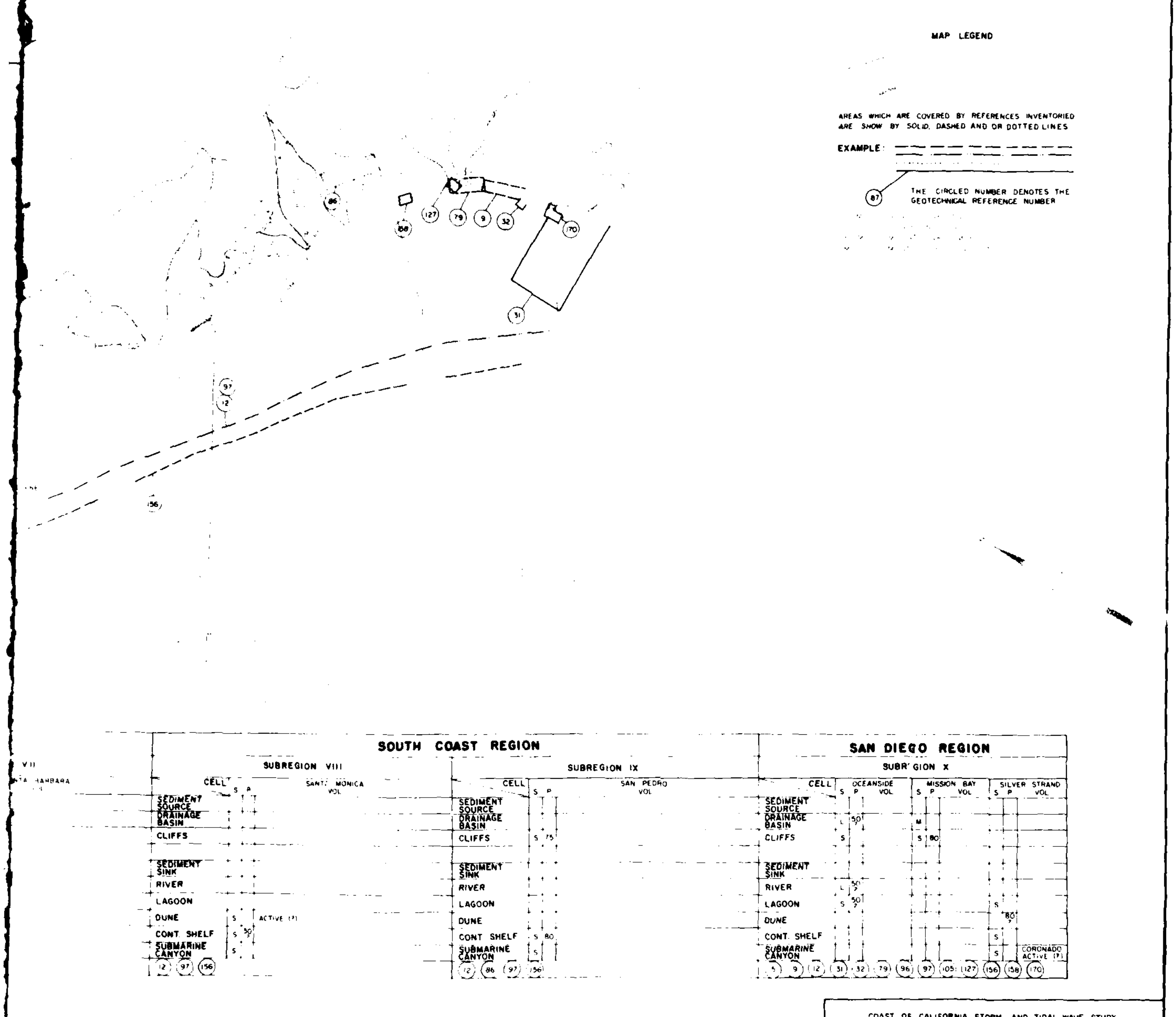
ABBREVATIONS

S RELATIVE SIZE (L LARGE, M MEDIUM, S SMALL)

P PERCENT SAND

Vol VOLUMN (1000'S OF CUBIC YARDS PER YEAR

VALUE ENGINEERING PAYS



COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

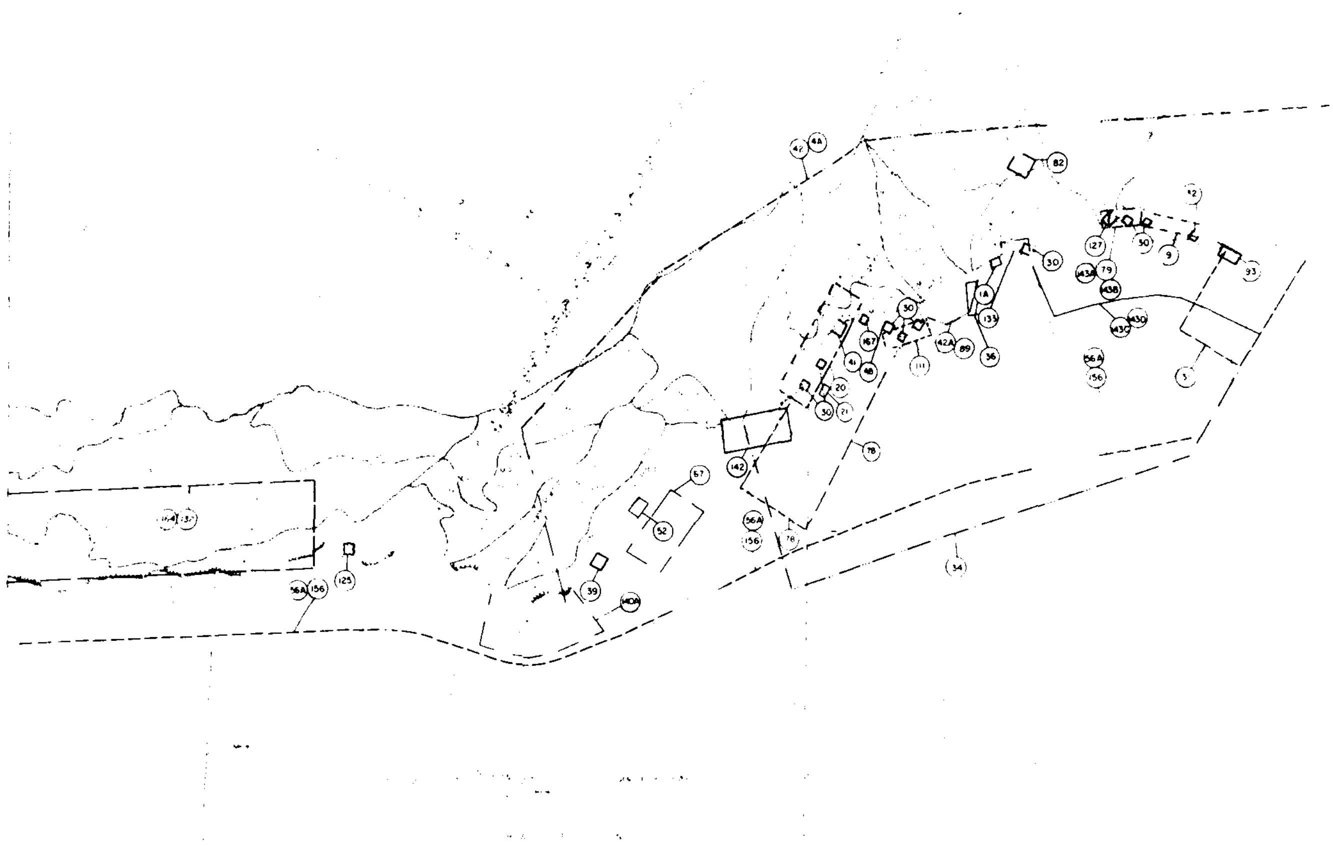
LITTORAL ZONE CELLS
AND
DATA INVENTORY
SOURCES AND SINKS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SAFETY PAYS

PLATE 3

VALUE ENGINEERING PAYS



SOUTH CENTRAL REGION

SUBREGION VI

AREA / CELL	MORRO BAY TEXT	MORRO BAY PET	SANTA MARIA TEXT	SANTA MARIA PET	SANTA YNEZ TEXT	SANTA YNEZ PET
DRAINAGE		E S G A H G				
RIVER				E A H C O		E A H C O
CLIFF						
LAGOON						
BEACH	2.74 MØ .04 SKØ		2.4 MØ	E A H C O	.25 M .25 S	
DUNES	2.56 MØ .04 SKØ					
CONT SHELF					.20 M .2 S	
SUB CANYON						

32, 125, 164, 56A, 40A, 156

SUBREGION VII

AREA / CELL	TEXTURE	SANTA BARBARA PETROLOGY
DRAINAGE		
RIVER	1.6 MØ Santa Clara	E 17-30, A 1-21, H 2-16, C 3-11, O 12-38
CLIFF		
LAGOON		
BEACH	0.8-2.8 MØ (Sand) 23-375 M (Gravel)	E 7-30, A 2-8, H 2-7, C 2-7, O 12-40
DUNES		
CONT SHELF	.2 M .10-.25 S	Q, PF, PE
SUB CANYON	0.03-3.0 M	

142, 52, 56A, 67, 39, 160, 156, MOA, 78

SOUTH COAST REGION

SUBREGION VIII

AREA / CELL	TEXTURE	SANTA MONICA PETROLOGY
DRAINAGE	0.05-2.0 M (Modelo Fm)	P, PF, Q, I, T, G, Z, H, TO
RIVER		E 17-29, A 12-20, H 4-16, C 3-10, O 12-31
CLIFF		
LAGOON		
BEACH	[illegible] 0.4 (Sand) 40-190 M (Gravel)	E 6-17, A 6-19, H 4-34, C 4-23, O 10-62
DUNES		
CONT SHELF	3.75 MØ .75 SØ	
SUB CANYON	[illegible] 38 M (fines)	Canyon Wall "Sandstone", "Dacite", "Limestone"

20, 56A, 1, 30, 41, 167, 21, 134, 160, 156, 78, 48

SUBREGION

AREA / CELL	TEXTURE
DRAINAGE	
RIVER	
CLIFF	*Coarse Sands and [illegible]
LAGOON	
BEACH	[illegible] 2.5 MØ
DUNES	
CONT SHELF	[illegible] MØ [illegible] SØ
SUB CANYON	[illegible] MØ [illegible] SØ

82, 4A, 133, [illegible]

NOTES

1. SEE TEXT FOR AN EXPLANATION OF MINERALS LISTED UNDER PETROLOGY
2. THE DATA LISTED HAS BEEN AVERAGED FROM DATA VALUES REPORTED IN THE LITERATURE. SEE TEXT FOR AVAILABLE DATA ON A AREA BY AREA BASIS
3. THE INFORMATION SHOWN ABOVE FOR TEXTURE AND PETROGRAPHIC DATA REPRESENTS AVERAGE VALUES FROM ONE OR MORE AREAS WITHIN CELL. SEE TEXT FOR THE AVAILABILITY OF DATA ON ANY SITE SPECIFIC AREA

ABBREVIATIONS

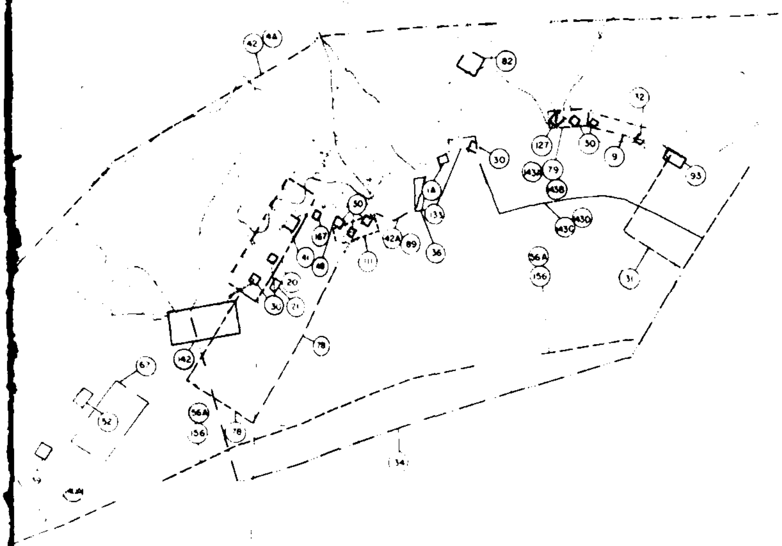
MØ	MEAN GRAIN SIZE IN PHI
M	MEAN GRAIN SIZE IN MILLIMETERS
SØ	SKEWNESS IN PHI
E	EPIDOTE
A	AUGITE
H	HORNBLEND
C	CHLORITE
O	OPAQUE
P	PLAGIOCLASE
PF	POTASSIUM FELDSPAR
Q	QUARTZ
I	IGNEOUS ROCKS
T	TITANITE
G	GARNITE
Z	ZOISITE
TO	TOURMALINE
S	SKEWNESS IN MILLIMETERS

ABUNDANCE DATA

E 9	9% AVERAGE ABUNDANCE OF EPIDOTE
O 12-31	12 TO 31% AVERAGE ABUNDANCE OF OPAQUE MINERALS

SAFETY PAYS

VALUE ENGINEERING PAYS



MAP LEGEND

AREAS WHICH ARE COVERED BY REFERENCES INVENTORIED ARE SHOW BY SOLID, DASHED AND OR DOTTED LINES

EXAMPLE:

(87) THE CIRCLED NUMBER DENOTES THE GEOTECHNICAL REFERENCE NUMBER

SOUTH COAST REGION

SUBREGION VIII

AREA \ CELL	SANTA MONICA TEXTURE	SANTA MONICA PETROLOGY
DRAINAGE	.05-2.0 M Modelo Fm)	P, PF, [illegible] Z, H, TO
RIVER		E [illegible] 29, A [illegible] 20, H 4-16, [illegible] 3-10, [illegible] 2-31
CLIFF		
LAGOON		
BEACH	[illegible] .04 Sand; 4[illegible]-90 M (Gravel)	E 6-[illegible], A 6-9, H 4-34, [illegible] 4-23, [illegible] 10-62
DUNES		
CONT SHELF	[illegible] 75 MØ [illegible] 5 SØ	
SUB CANYON	[illegible] 38 M (Dune)	Canyon Wall "Sandstone", [illegible] "Limestone"

(20) (56A) [illegible] (30) (41) (67) (21) (34) [illegible]

SUBREGION IX

AREA \ CELL	SAN PEDRO TEXTURE	SAN PEDRO PETROLOGY
DRAINAGE		
RIVER		E 9, A 5, H 23, C 12, O 33
CLIFF	"Coarse Sands and Cobbles"	[illegible] Gabbro, Serpentinite Clasts)
LAGOON		
BEACH	1.3-2.5 MØ	Q, P, PF, Heavy Minerals
DUNES		
CONT SHELF	3.[illegible] MØ 0.75 SØ	
SUB CANYON	3.[illegible] MØ 0.3 [illegible] 0.75 SØ	

(87) (4A) (133) (1A) (36) (42A) (8) (14) (61) (56) (56A) (42)

SAN DIEGO REGION

SUBREGION X

AREA \ CELL	OCEANSIDE TEXT	OCEANSIDE PET	MISSION BAY TEXT	MISSION BAY PET	SILVER STRAND TEXT	SILVER STRAND PET
DRAINAGE						
RIVER	.064 to 34 MØ	P, Q, H				
CLIFF	1.3-2.4 MØ	P, PF, Q, B, H				
LAGOON	1.8-2.5 MØ	P, PF, Q, B, H				
BEACH	.26 to 3.6 MØ	P, PF, Q HM	1.7-2.6 MØ	P, Q, PF HM	2.5-1.5 MØ	P, PF, Q, HM
DUNES						
CONT SHELF	4.0 MØ 0.75 SØ		"Sand"		"Gravel" "Sand"	1, M, V
SUB CANYON	Canyon wall "Shale" "Sandstone" Can Wall					

(127) (143A) (9) (42) (30) (143C) (143B) (34) (93) (156) (143D) (31) (160) (56A)

ABBREVIATIONS

ABUNDANCE DATA

E 9 — % AVERAGE ABUNDANCE OF EPIDOTE

O 2-31 — 2-31% AVERAGE ABUNDANCE OF OPAQUE MINERALS

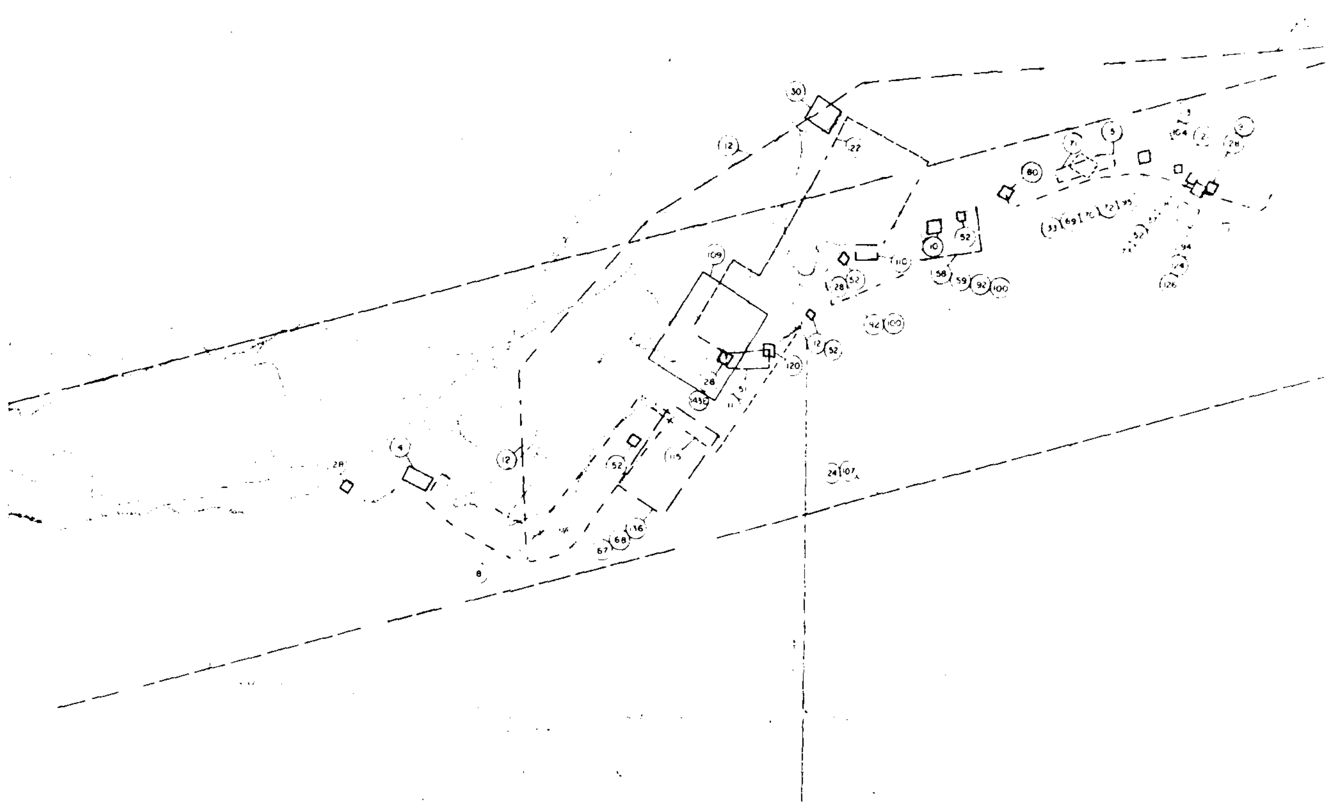
COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

LITTORAL ZONE CELLS AND DATA INVENTORY SEDIMENT CHARACTERISTICS

U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT

SAFETY PAYS



SOUTH CENTRAL REGION

SUBREGION VI

CELL	MORRO BAY E	MORRO BAY VOL	MORRO BAY AW	SANTA MARIA E	SANTA MARIA VOL	SANTA MARIA AW	SANTA YNEZ E	SANTA YNEZ VOL	SANTA YNEZ AW
EROSION									
CLIFF				Q	40 CY/y, 0-10 F/y			25 CY/y	
FLUVIAL									
LITTORAL									
DEPOSITION									
FLUVIAL									
LAGOON									
SHELF	R			S			S		
DELTA									
SUBMARINE CANYON									
AEOLIAN				D	50 CY/y	NW W	D	80 CY/y	NW W
LITTORAL									

4 8 24 28 107

SUBREGION VII

CELL	E	SANTA BARBARA VOL	AW
EROSION			
CLIFF			
FLUVIAL			
LITTORAL	Goleta Beach	0.1-3 CY/d	
DEPOSITION			
FLUVIAL			
LAGOON			
SHELF	S BARBARA SW OXNARD NW	VENTURA-PT MUGU 50 cm (SEE NOTE 2)	
DELTA		SANTA CLARA 13.2 CY	ST 1969
SUBMARINE CANYON			
AEOLIAN			
LITTORAL	WIDTH 0' to 30' MLLW	INTERBEDDED SANDS 1-2 mm Th	

8 [illegible] 2 24 28 51 52 67 68 107 109 115 120 143C

SOUTH COAST REGION

SUBREGION VIII

CELL	E	SANTA MONICA VOL	AW
EROSION			
CLIFF			
FLUVIAL			
LITTORAL	SANTA MONICA TRANCAS	.08 to .4 CY/d, 0.? to ? CY/d	
DEPOSITION			
FLUVIAL			
LAGOON			
SHELF	PT DUME SW, P VERDES S-SW	S MONICA BASIN 1,200 CY/y	WINTER
DELTA			
SUBMARINE CANYON	DISTRIBUTARY CHANNELS		
AEOLIAN	EL SEGUNDO SAND HILLS	INACTIVE	
LITTORAL			

12 24 28 52 81 92 100 107 110 30 122 108

SUBREGION

CELL	E
EROSION	
CLIFF	
FLUVIAL	SAN GABRIEL MTS
LITTORAL	HUNTINGTON BEACH
DEPOSITION	
FLUVIAL	
LAGOON	
SHELF	SAN PEDRO SHELF NW
DELTA	
SUBMARINE CANYON	SAN PEDRO
AEOLIAN	
LITTORAL	

8 12 24 52 59 8? 92 10?

ABBREVATIONS

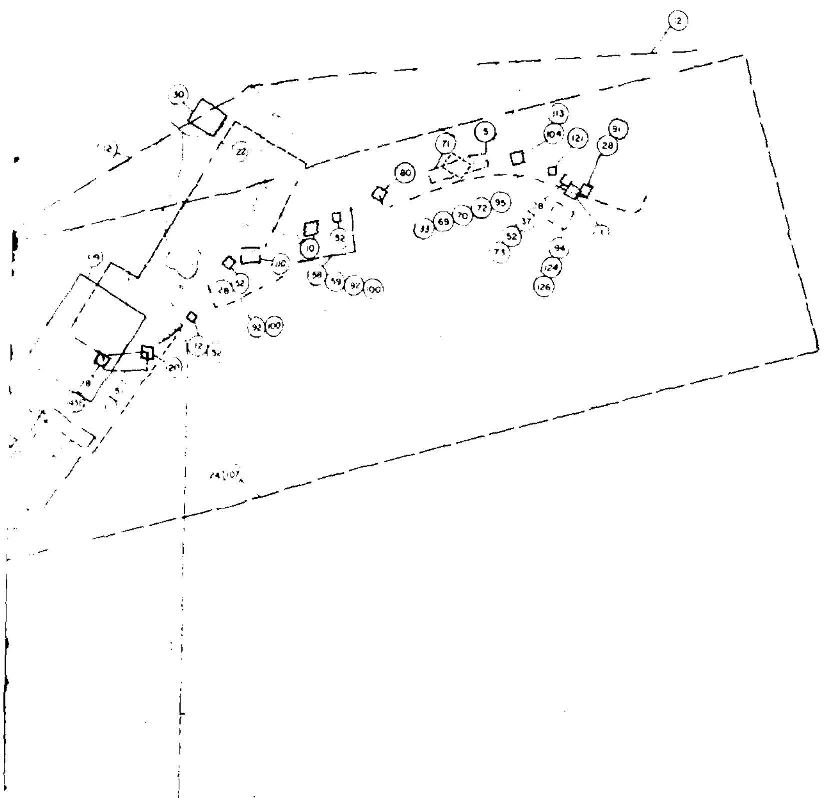
E	ENVIRONMENT	W	WIND
R	RIP CURRANTS	VOL	VOLUMN (CY) OR RATE (CY/Y) IN 1000
[illegible]	[illegible]	AW	[illegible] WEATHER
Q	QUATERNARY ROCKS	F	FEET
T	TERTIARY ROCKS	CY	CUBIC YARD
C	CRETACEOUS ROCKS	Y	YEAR
TH	THICK	m	METERS
S	SURFACE CURRANTS	d	DAY
ST	STORM	cm	CENTIMETER
D	DUNES	mm	MILIMETER
NW	NORTH WEST		INCHES

NOTES

1 REFERENCES 81, 130, 108, 97 WERE NOT PLOTTED

2 THICKNESS DATA IS CITED WHERE VOLMETERIC INFORMATION WAS NOT AVAILABLE

VALUE ENGINEERING PAYS



MAP LEGEND

AREAS WHICH ARE COVERED BY REFERENCES INVENTORIED ARE SHOW BY SOLID, DASHED AND OR DOTTED LINES

EXAMPLE:

87 THE CIRCLED NUMBER DENOTES THE GEOTECHNICAL REFERENCE

SOUTH COAST REGION

SUBREGION VIII

EROSION / DEPOSITION (CELL)	SANTA MONICA E	VOL	AW
CLIFF			
FLUVIAL			
LITTORAL	SANTA MONICA TRANCAS	[illegible]	
DEPOSITION			
FLUVIAL			
LAGOON			
SHELF	PT DUME SW P VERDES S-SW	S MONICA BASIN 1,200	WINTER
DELTA			
SUBMARINE CANYON	DISTRIBUTARY CHANNELS		
AEOLIAN	EL SEGUNDO SAND HILLS	INACTIVE	
LITTORAL			
REFERENCES	2 24 28 52 81 92 100 107 10 30 122 108		

SUBREGION IX

EROSION / DEPOSITION (CELL)	SAN PEDRO E	VOL	AW
CLIFF		[illegible] 0.2 ... 1.2 ... 0.9 (SEE NOTE 2)	
FLUVIAL	SAN GABRIEL MTS	0.1 /y (SEE NOTE 2)	
LITTORAL	HUNTINGTON BEACH	0.08-2.9 (SEE NOTE 2)	
DEPOSITION			
FLUVIAL			
LAGOON			
SHELF	SAN PEDRO SHELF NW	0.01-0.06 (SEE NOTE 2)	
DELTA			
SUBMARINE CANYON	SAN PEDRO	(?) INACTIVE	
AEOLIAN			
LITTORAL			
REFERENCES	108 12 24 52 59 80 92 100 107 130 10		

SAN DIEGO REGION

SUBREGION X

EROSION / DEPOSITION (CELL)	OCEANSIDE E	OCEANSIDE VOL	OCEANSIDE AW	MISSION BAY E	MISSION BAY VOL	MISSION BAY AW	SILVER STRAND E	SILVER STRAND VOL	SILVER STRAND AW
CLIFF		300 cu/y 50 cu/d	ST 80		1-3 1/y (SEE NOTE 2)				
FLUVIAL									
LITTORAL		0.9 cu/d							
DEPOSITION									
FLUVIAL									
LAGOON		150 cu/y			6"/100 y * (SEE NOTE 2)				
SHELF									
DELTA									
SUBMARINE CANYON		10 mm/100 y (SEE NOTE 2)							
AEOLIAN									
LITTORAL									
REFERENCES	5 12 24 28 33 37 52 63 69 70 71 72 73 94 95 97 104 107 113 121 124 126								

* LAGOON'S MOUTH IS VERY RESTRICTED

COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

LITTORAL ZONE CELLS AND DATA INVENTORY

GEOLOGIC PROCESSES

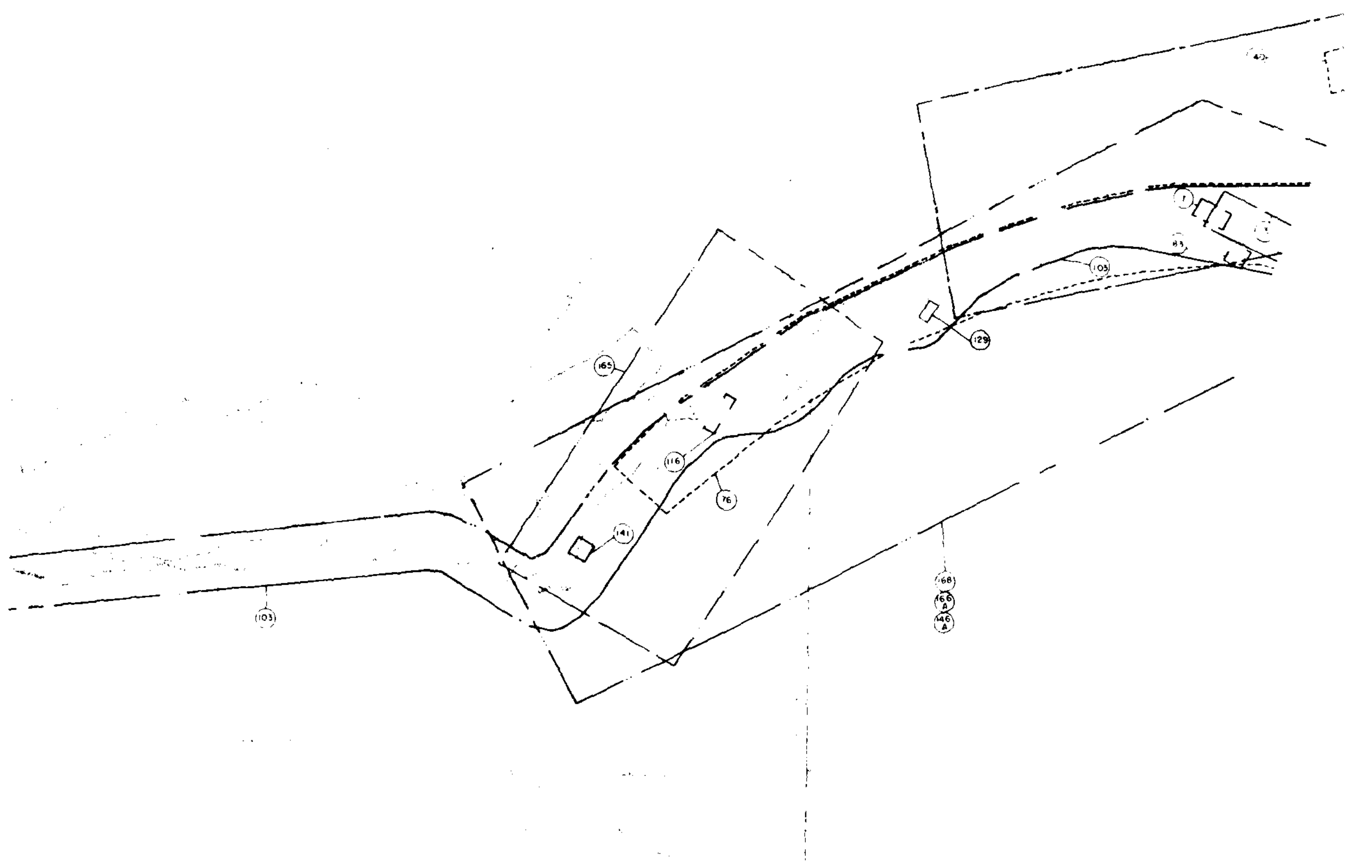
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

2

SAFETY PAYS

PLATE 5

VALUE ENGINEERING PAYS



SOUTH CENTRAL REGION

SUBREGION VI

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE	MORRO BAY		(2) NONE	
	SAN MARIA		(2) NONE	
	SANTA YNEZ RIVER		(2) NONE	
EMERGENCE (103)	MORRO BAY	San Simeon Cambria	HIGHEST 600' MLLW LOWEST 20'-30' MLLW	UNK
	SANTA MARIA	Arroyo Grande	HIGHEST 400' MLLW LOWEST 30'-50' MLLW	UNK
	SANTA YNEZ RIVER	Casmalia Tranquillon MT	HIGHEST 700' MLLW LOWEST 30'-50' MLLW	UNK
TECTONIC AREAS	CELL	AREA	ACTIVE FAULTS	TYPE
29A	MORRO BAY	OFFSHORE	PALO COLORADO SAN GREGORIO HOSGRI	
29A	SANTA MARIA	OFFSHORE	PALO COLORADO GREGORIO PURISMA PLEASANTON	
29A	SANTA YNEZ RIVER	(2) NONE		

SUBREGION VII

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE	SANTA BARBARA	(2) NONE		
EMERGENCE (103) 76	SANTA BARBARA	PT Arguello to Carpenteria	HIGHEST 600' MLLW LOWEST 50-100' MLLW	UNK
		Carpenteria to Pitas PT	HIGHEST 2100' MLLW LOWEST 250'-800' MLLW 5-15'/50 Yrs	
TECTONIC AREAS	CELL	AREA	ACTIVE FAULTS	TYPE
76 116 141 165 168 146A 166A 29A	SANTA BARBARA	PT Arguello to Carpenteria	(2) NONE	
		Carpenteria to Pitas PT	RED MOUNTAIN OAKRIDGE	THRUST
		Point Mugu to Solarmar	(2) NONE	
		Pitas PT to Ventura	VENTURA AVE	THRUST
		Pitas PT to Ventura	HIGHEST 900' MLLW LOWEST 100-250' MLLW	UNK
		Point Mugu to Solarmar	HIGHEST 1050' MLLW LOWEST 50-70' MLLW	UNK

SOUTH COAST REGION

SUBREGION VIII

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE	SANTA MONICA	UNK		
EMERGENCE (103)	SANTA MONICA	PT Dume to Santa Monica	HIGHEST [illegible] MLLW LOWEST 100' MLLW 4'/50 Yrs	
		Palos Verdes	HIGHEST 1200' MLLW LOWEST 100' MLLW	
TECTONIC AREAS	CELL	AREA	ACTIVE FAULTS	TYPE
76 168 146A 166A 29A	SANTA MONICA	INGLEWOOD	NEWPORT-INGLEWOOD SANTA MONICA-MALIBU CHARNAC	STRIKE

SUBREGION IX

	CELL	AREA
SUBSIDENCE (291)	SAN PEDRO	Termino [illegible]
EMERGENCE (103) (130)	SAN PEDRO	Newport Head to San Clemente
TECTONIC AREAS	CELL	AREA
76 168 146A 166A 130 29A	SAN PEDRO	NEWPORT [illegible] CANA [illegible]

NOTES

1. FOR AN EXPLANATION OF THE INVENTORY CATAGORIES ("ELEVATION CHANGE" AND "CAUSE") SEE THE APPROPRIATE SECTIONS OF THE INVENTORY REPORT
2. THE DATA LISTED UNDER "HIGHEST AND LOWEST" REFER TO THE ELEVATION OF THE HIGHEST AND LOWEST MARINE TERRACE THAT HAVE BEEN MAPPED ALONG THE COASTLINE. ADDITIONAL INFORMATION IS ALSO GIVEN ON THE RATE OF COASTAL UPLIFT (EMERGENCE) WHERE APPROPIATE

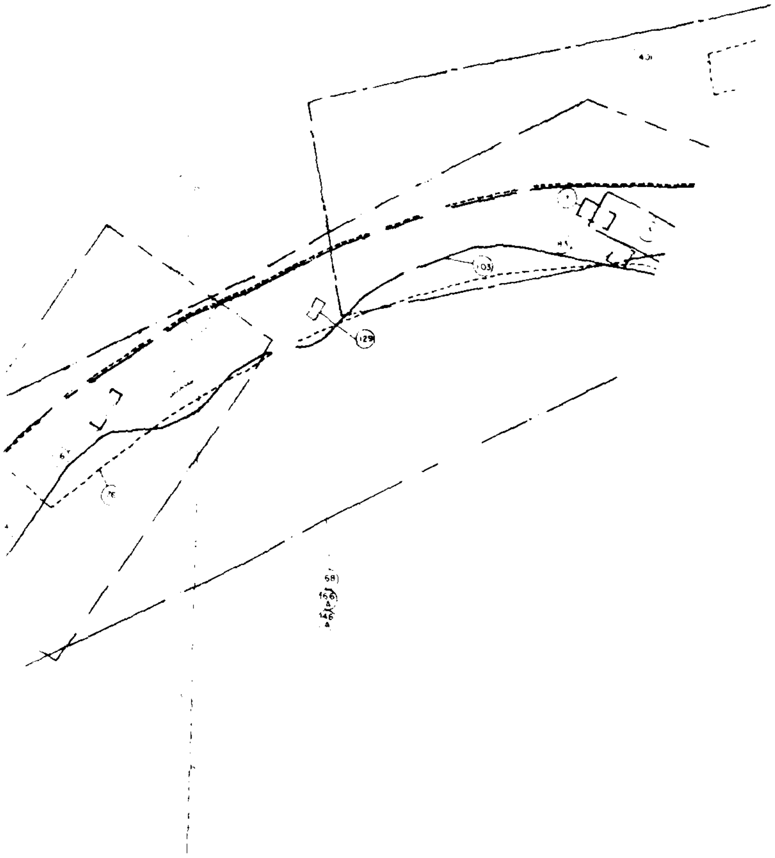
EXAMPLE (2") (2"/YR)

3. REFERENCE NOT PLOTTED (29A)

ABBREVIATIONS
UNK THE CAUSE IS UNKNOWN

SAFETY PAYS

VALUE ENGINEERING PAYS



MAP LEGEND

AREAS WHICH ARE COVERED BY REFERENCES INVENTORIED ARE SHOW BY SOLID, DASHED AND OR DOTTED LINE

EXAMPLE

(87) THE CIRCLED NUMBER DENOTES THE GEOTECHNICAL REFERENCE

SOUTH COAST REGION

SUBREGION VIII

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE	SANTA MONICA	UNK		
EMERGENCE	SANTA MONICA	[illegible] to Santa Monica	HIGHEST 900' MLLW LOWEST 100' MLLW 4" / 50 Yrs	
(103)		Palos Verdes	HIGHEST 1200' MLLW LOWEST 100' MLLW	
	CELL	AREA	ACTIVE FAULTS	TYPE
TECTONIC AREAS (76) (168) (146 A) (166 A) (29A)	SANTA MONICA	INGLEWOOD	NEWPORT INGLEWOOD SANTA MONICA-MALIBU CHARNAC	STRIKE

SUBREGION IX

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE (29)	SAN PEDRO	Terminal Island	[illegible] 28' [illegible]	Oil-Gas Prod
EMERGENCE (103) (130)	SAN PEDRO	Newport Beach to San Clemente	HIGHEST 700' MLLW LOWEST 50' MLLW 2" - 12" / 50 Yrs	
	CELL	AREA	ACTIVE FAULTS	TYPE
TECTONIC AREAS (76) (168) (146 A) (166 A) (130)	SAN PEDRO	NEWPORT	NEWPORT-INGLEWOOD	STRIKE
		DANA PT	SHADY CANYON	(1) Normal

SAN DIEGO REGION

SUBREGION X

	CELL	AREA	ELEVATION CHANGE	CAUSE
SUBSIDENCE (43)	Oceans de Mission Bay	LAJOLLA UNK	-7cm / 100 Yrs	UNK
	SILVER STRAND	UNK		
EMERGENCE (103)	Oceanside	San Clemente to Mission Beach	HIGHEST 650' MLLW LOWEST 30' MLLW 2 - 12" / 50 Yrs	UNK
	Mission Bay	INLAND	HIGHEST 525' MLLW LOWEST 20' MLLW 2" - 12" / 50 Yrs	UNK
	CELL	AREA	ACTIVE FAULTS	TYPE
TECTONIC AREAS (3) ( ) (43) (76) (83) (140) (162) (168) (146 A) (166 A) (129 A)	Oceanside	DANA PT OFFSHORE	NEWPORT-INGLEWOOD (1) CRIST[illegible]AN TOS (1) ROSE CANYON FAULT	STRIKE THRUST STRIKE
	Mission Bay	INLAND		
	SILVER STRAND	SAN DIEGO BAY	(1) ROSE CANYON FAULT	STRIKE

COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

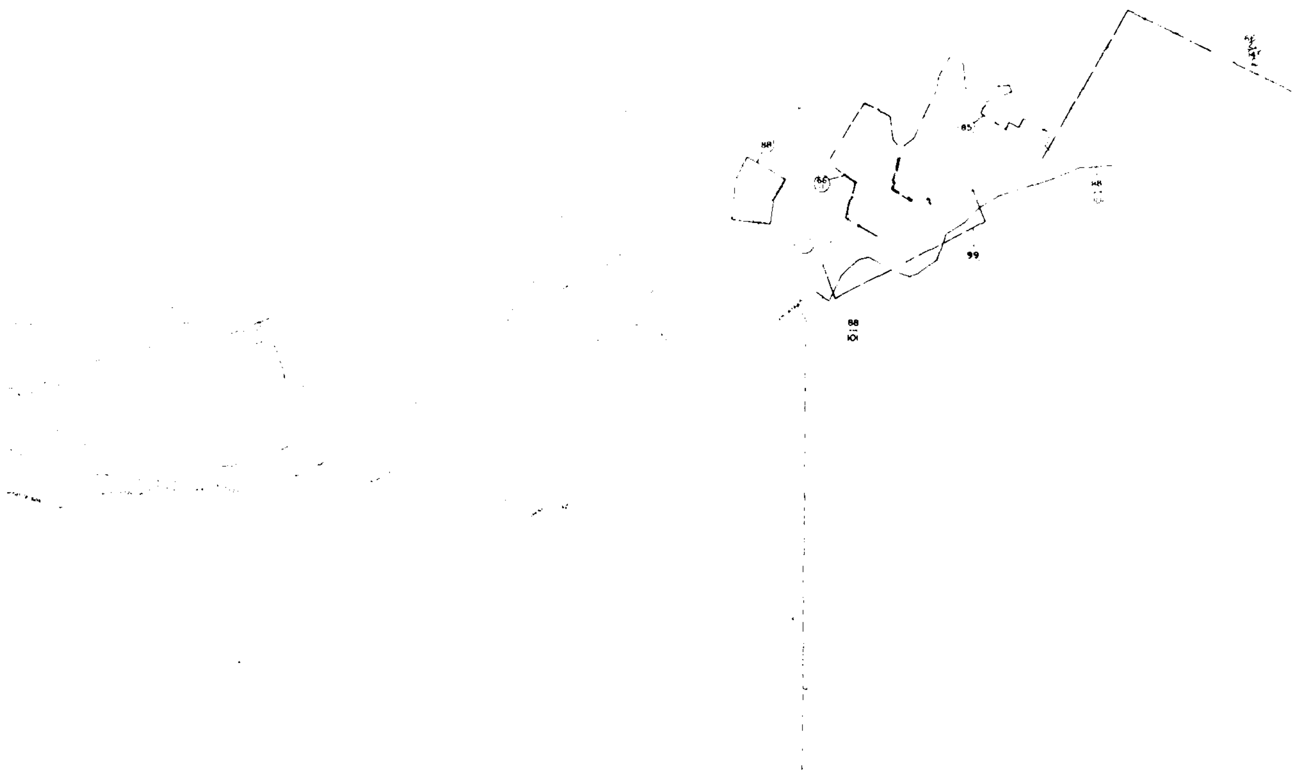
LITTORAL ZONE CELLS AND DATA INVENTORY LAND MASS CHANGES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 6

SAFETY PAYS

VALUE ENGINEERING PAYS



SOUTH CENTRAL REGION

SUBREGION VI

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
MORRO BAY			
SANTA MARIA			
SANTA INEZ			

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	YEAR
MORRO BAY			
SANTA MARIA			
SANTA INEZ			

SUBREGION VII

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
SANTA BARBARA	Upper Santa Clara River	[illegible] million yds	1975

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	YEAR
SANTA BARBARA			

REFERENCE (88)

NOTE
REFER TO TEXT FOR OFFSHORE SAND AND GRAVEL RESOURCE DATA

SOUTH COAST REGION

SUBREGION VIII

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
SANTA MONICA			

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	YEAR
SANTA MONICA			

SUBREGION IX

QUANTITIES

CELL	AREA	PRODUCT[illegible]
SAN PEDRO	[illegible]	[illegible]
	Orange [illegible]	[illegible]
	Upper Tujunga Wash	[illegible]

IMPACT ON LITTORAL SEDIMENT B[illegible]

CELL	AREA	PROJECT[illegible] CONSUMP[illegible]
SAN PEDRO	[illegible]	[illegible]
	Orange [illegible]	[illegible]
	Upper Tujunga Wash	[illegible]

86 85 88

SAFETY PAYS

VALUE ENGINEERING PAYS

MAP LEGEND

AREAS WHICH ARE COVERED BY REFERENCES INVENTORIED ARE SHOW BY SOLID, DASHED AND OR DOTTED LINES

EXAMPLE:

87 THE CIRCLED NUMBER DENOTES THE GEOTECHNICAL REFERENCE

END 6-84

SOUTH COAST REGION

SUBREGION VIII

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
SANTA MONICA			

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	YEAR
SANTA MONICA			

SUBREGION IX

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
SAN PEDRO	[illegible]	[illegible]	1975
	[illegible]	[illegible]	1977
	Upper [illegible] Wash	[illegible]	1975

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	PERIOD
SAN PEDRO	[illegible]	[illegible]	1985-1990
	[illegible]	5 [illegible] million yds³	1985-1990
	Upper [illegible] Wash	[illegible]	

66 85 88

SAN DIEGO REGION

SUBREGION X

QUANTITIES

CELL	AREA	PRODUCTION	YEAR
OCEANSIDE	Western San Diego County	1.5 million yds³	annual average 1947-1956
MISSION BEACH			
SILVER STRAND			

IMPACT ON LITTORAL SEDIMENT BUDGET

CELL	AREA	PROJECTED CONSUMPTION	PERIOD
OCEANSIDE	Western San Diego County	[illegible] million yds³	1985-[illegible]
MISSION BEACH			
SILVER STRAND			

66 143

COAST OF CALIFORNIA STORM AND TIDAL WAVE STUDY

OREGON BOUNDARY TO MEXICAN BORDER

LITTORAL ZONE CELLS AND DATA INVENTORY SAND AND GRAVEL MINING

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SAFETY PAYS

PLATE 7